

From Detection to Desensitization: The limited effectiveness of technological bird deterrents at Trabzon International Airport, Türkiye

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Introduction

Bird-aircraft collisions are a major threat to aviation safety, especially at airports with high bird activity. In recent years, technological deterrents such as bioacoustic and ultrasonic devices have gained popularity. However, their long-term effectiveness remains unclear. This study focuses on the behavioural responses and desensitization patterns of resident birds at Trabzon International Airport (TIA), Türkiye, following the deployment of such deterrents.



Methods

Between August 2021 and November 2022, three types of bird deterrent systems were deployed at three critical zones within and around TIA:

- Bird-Xpeller® PRO (bioacoustic) (A)
 - Bird-K Imti 040 (ultrasonic) (B)
 - Golden jackal replica emitting predatory sounds (C)
 - All deterrent systems were powered using a CTECHI 300W portable power station, ensuring uninterrupted operation in the field. (D)
- Observations were conducted during both migratory and non-migratory periods using: Camera traps, Binocular-based field scanning, Direct behavioral monitoring
- Bird reactions were recorded at short intervals (0–30 min) after deterrent activation. Vegetation height around the devices was also monitored to assess the attractiveness of the habitat.



A



C



B



D

Results

During the study period at TIA (August 13, 2021 – November 13, 2022), a total of 114 field surveys were conducted. Observations resulted in the identification of 120 bird species belonging to 44 families. Among the resident bird species at TIA, hooded crow, yellow-legged gull, and rock dove pose the greatest year-round risk to flight safety.



White stork



Purple heron



Yellow-legged gull



Hooded crow



Rock dove

BIRD RESPONSES TO THE DETERRENT SYSTEMS

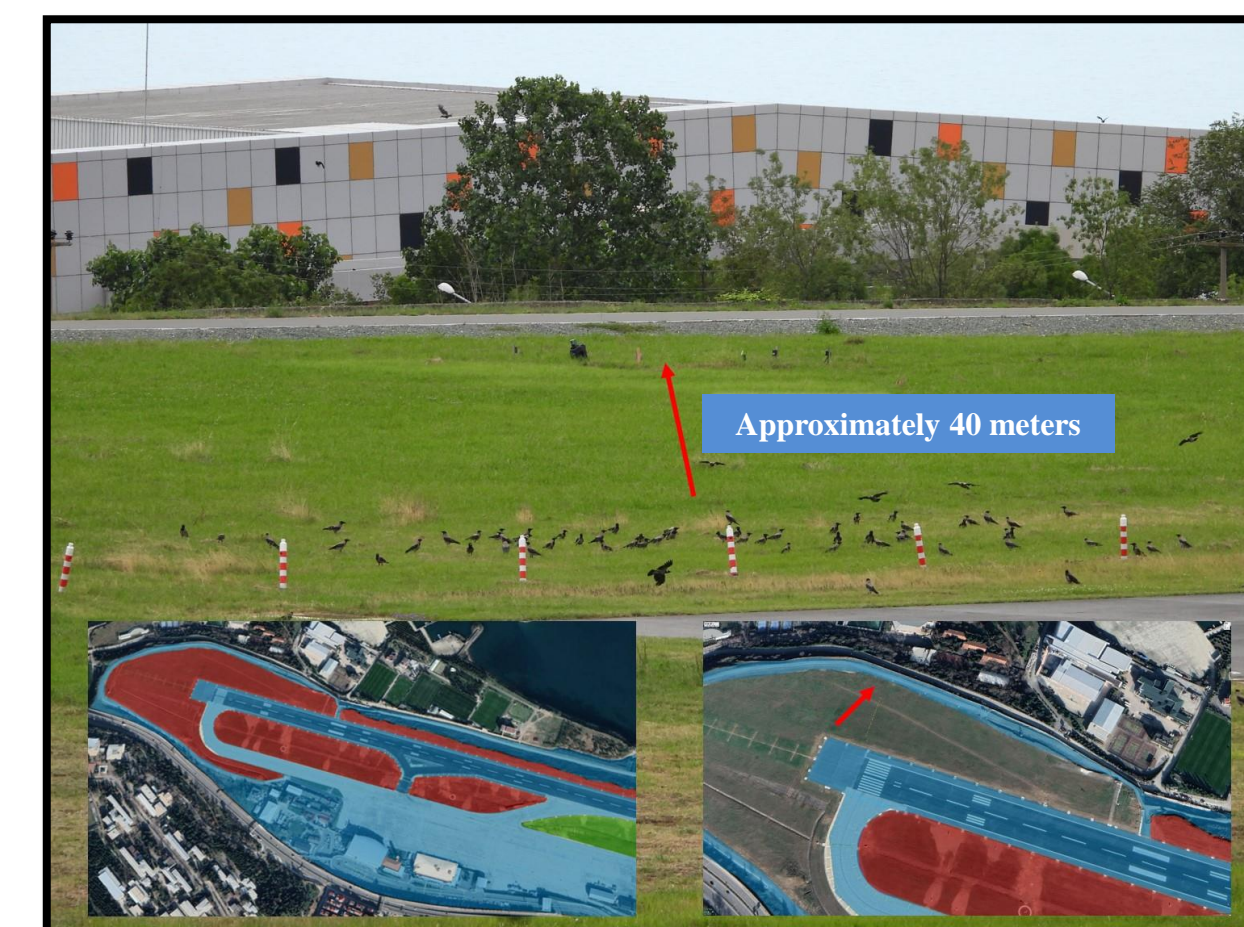
Bird Species	Initial Reaction	Return Time (min)	Landed Near Device
Hooded Crow	Short flight	30	Yes
Yellow-legged Gull	Circling	20	Yes
Rock Dove	Short flight	10	Yes
Grey Heron	Short flight	15	Yes
Migratory Birds	Prolonged avoidance	45	Yes (later adapted)

Resident birds, especially hooded crow, yellow-legged gull, and rock dove, showed rapid habituation to deterrent systems.

Initial reactions:

- Short-term flight, circling, brief avoidance (10–30 minutes)
- Most birds returned quickly and even landed on or near the devices
- Migratory birds showed slightly longer avoidance but adapted over time
- Short vegetation increased landing rates

Birds frequently returned to the area and even landed near or on the devices. In contrast, migratory birds showed slightly longer avoidance, but gradually resumed use of the same zones. Short vegetation around deterrents increased landing frequency, suggesting habitat conditions significantly affect effectiveness.



Discussion - Conclusions

The study revealed that technological bird deterrents such as bioacoustic and ultrasonic systems have limited long-term effectiveness at Trabzon International Airport.

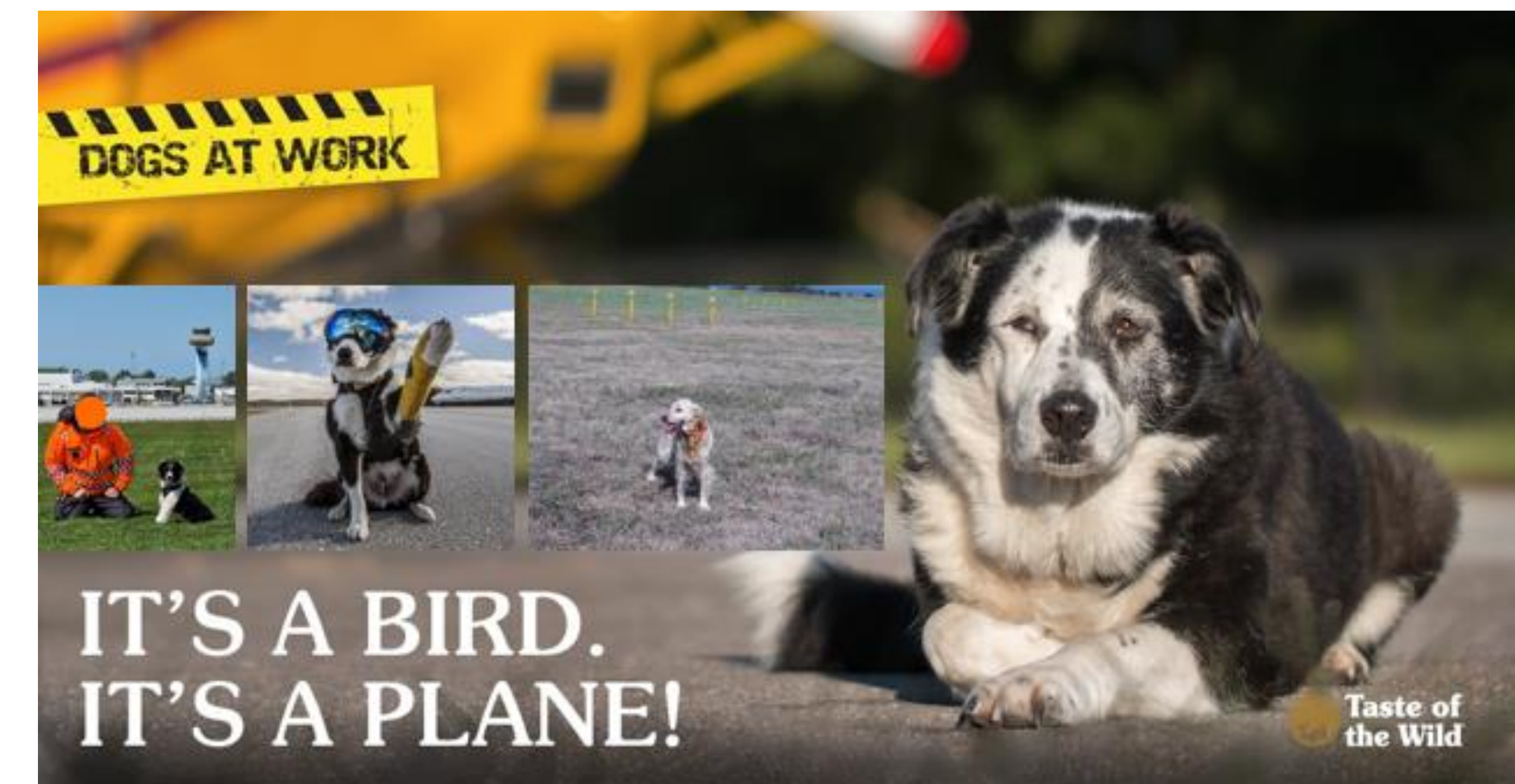
While initial disturbance responses were observed among both resident and migratory birds, especially Rock Doves, Yellow-legged Gulls, and Hooded Crows quickly adapted to all deterrent types.

Sensory habituation and favorable ground conditions (e.g., short vegetation) significantly reduced the deterrents' impact.

These findings emphasize the importance of integrating ecological strategies, such as:

- Habitat modification (vegetation management)
- Use of trained dogs or biological control
- Adaptive, multi-method approaches tailored to bird behavior and seasonality

Overall, relying solely on technological deterrents poses a high risk of desensitization and should be avoided in sustainable airport wildlife management programs. Integrating biological deterrents and ecology-based grass management represents the future of safe skies and wildlife-conscious airport operations.



References

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