Short Communication

Spotless Starling (*Sturnus unicolor*) in a Sardinian town (Italy): mechanical anti-perching deterrents are not effective in high density roosts

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Abstract - In this note we report data on autumn-winter roosting density and behaviour of Spotless Starling (*Sturnus unicolor*), a poorly studied species of high biogeographic interest, carried out in a small urban town of northern Sardinia (Bonorva, Sassari). Spotless Starlings were recorded between October 2021 and February 2022 (n=4,272), with a maximum number of records in November (mean values: >800 ind./km), significantly decreasing until February. Compared to trees, buildings appear to represent privileged perching sites (contrary to what is known for the Common Starling, *Sturnus vulgaris*): they were probably selected for the higher temperatures and for the absence of nocturnal predators. Although metal deterrents traditionally used for pigeons have been installed on some buildings locally, the smaller starlings still settle between the steel spikes, partly due to their ability to perch on very small surfaces. Given the ineffectiveness of these anti-perching devices, it will be important to modify the distance, density and inclination of the steel tips (originally defined for pigeons) to adapt them to the size and behavior of Spotless Starlings or creatively develop alternative and non-lethal solutions to limit the number of these birds creating conflicts with citizens.

Key words: bird spikes, density pattern, human-wildlife conflicts, ineffectiveness, mitigation devices.

Riassunto - Storni neri (*Sturnus unicolor*) in un centro abitato della Sardegna (Italia): i deterrenti meccanici per impedirne la sosta non funzionano nei dormitori ad alta densità.

In questa nota riportiamo dati preliminari sulla densità e sul comportamento (in dormitori autunno-invernali) dello storno nero (*Sturnus unicolor*), specie poco studiata e di elevato interesse biogeografico, in un centro urbano della Sardegna settentrionale (Bonorva, Sassari). Gli storni sono stati conteggiati tra ottobre 2021 e febbraio 2022 (n=4.272), con un numero massimo di segnalazioni a novembre (valori medi: >800 ind./km), in calo significativo fino a febbraio. Gli edifici sembrano rappresentare siti di posatoio privilegiati rispetto agli alberi (contrariamente a quanto noto per lo storno comune, *Sturnus vulgaris*); i primi probabilmente selezionati per le temperature più elevate e per l'assenza di predatori notturni. Sebbene, localmente, su alcuni edifici siano stati posizionati dissuasori metallici, atti a impedire la sosta e tradizionalmente utilizzati per i piccioni, gli storni, di dimensioni inferiori, si posizionano comunque tra le punte d'acciaio anche a causa della loro capacità di sostare su superfici molto ridotte. Data l'inefficacia di questi dispositivi, sarà importante modificare la distanza, la densità e l'inclinazione delle punte in acciaio (originariamente messe a punto per i piccioni) per adattarle alle dimensioni e al comportamento degli storni neri o sviluppare altre soluzioni incruente per limitare il numero di questi animali, riducendo così il conflitto con i cittadini.

Parole chiave: andamento di densità, conflitti socio-ambientali, dispositivi meccanici, dissuasori, inefficacia.

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Received for publication: 1 September 2025
Accepted for publication: 24 September 2025
Online publication: 23 November 2026

Spotless Starling (*Sturnus unicolor* Temmink, 1820) is an endemic passerine of western Mediterranean (Iberian Peninsula, North Africa, South France, Corsica, Sardinia, and Sicily; Del Hoyo *et al.*, 2010). In Italy, this species breeds in Sicily (Massa, 1985) and Sardinia (Grussu, 2001; Battisti *et al.*, 2022), with scanty records for peninsular Italy (e.g., Simoncini *et al.*, 2018; Surdo, 2022). A large number of studies have been published, mainly carried out in Iberian peninsula, on behavioural ecology and breeding density (Walter & Demartis, 1972; Bulmer *et al.*, 2008; López-Rull *et al.*, 2008; Navarro *et al.*, 2010), diet (Motis *et al.*, 1997), breeding ecology (Hernández-Brito *et al.*, 2014; De La Hera, 2019), sex differentiation (Lezana *et al.*, 2000), genetic (Cordero *et al.*, 2004; Celis *et al.*, 2007), biogeography and range dynamics (Berta *et al.*, 1981), bioacoustic (Motis, 1996), nest parasitism (Calvo *et al.*, 2000; Eens & Pinxten, 1999), parasites (Pellegrino *et al.*, 2021; de la Peña *et al.*, 2024), interspecific relationships (Hernández, 2000). However, data about urban autumn-winter roosting density and behaviour are still scanty for this species.

During the autumn-winter period, Spotless Starlings use as roosting sites both natural areas (rocky habitats, wetland reedbeds: Pérez-García, 2012; Ventim *et al.*, 2012) and urban towns where they can concentrate in

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high numbers, also creating management problems and conflicts both with citizens (due to accumulations of guano on roads and vehicles, noise from vocalizations, accumulation of carcasses, possible pathologies) and with farmers in suburban agricultural areas (the species can cause damage on farms and croplands: Monteagudo *et al.*, 2023; Sánchez-Cano *et al.*, 2024), similarly to the problems created by the roosts of Common Starling *Sturnus vulgaris* (Singer *et al.*, 1977; Cabe, 2021).

In this note we report preliminary data on an autumn-winter census carried out in a small town of northern Sardinia to highlight the local pattern in density of Spotless Starlings, to stimulate further research on this poorly studied species (Sarà, 2023), considered of high biogeographic interest (Massa, 2006). To our knowledge this is the first census for Italy on the Spotless Starling in autumn-winter roosts, also reporting a peculiar behaviour of avoidance of anti-perching mechanical deterrents.

The study was carried out in Bonorva (province of Sassari; geographical coordinates: 40°25'04.3"N; 8°46›02.7»E; 509 m a.s.l.), a small town (3,058 inhabitants) located in Northern Sardinia (Italy). We focused our attention on a central sector (category Corine 1.1.1 - Continuous urban settlements; Bossard *et al*., 2000). chosen by the species as a roosting site on both historic and recent buildings (height: 1-4 floors). To obtain values in abundance of Spotless Starlings, we selected four main streets of the historic center (Corso Vittorio Emanuele II: 277 m in linear length; Corso Umberto I: 460 m; Piazza Santa Maria: 126 m; via Dante Alighieri: 211 m) for a total of 1,074 m in length, along which, in evening hours (18:00-21:00), specific linear transects were carried out, counting on both sides of the streets all individuals perched on all architectural structures (window sills, balconies, cornices, roofs, antennas and so on) of the buildings.

Seven visits were carried out (from 29 October 2021 to 13 February 2022: one in October, three in November, one in December, and two in February; no data were obtained in January; Table 1; total research effort: approximately 14 hours). For the months of November and February, the maximum number of individuals over multiple visits was also obtained. The data were grouped by month, obtaining data on mean abundance (and standard deviation) of Spotless Starlings. The abundance data were transformed into density values (i.e., normalized abundance) using the Abundance Kilometric Index [AKI = (number of individuals on both sides of the roads/length of the transects)x1000] (Bibby *et al.*, 1992). Averaged values of density have been compared using the Kruskall-Wallis test for equal medians (>2 cases) and the Mann-Whitney U test (2 cases). Alpha was set at 0.05 level, using the PAST software (Hammer *et al.*, 2001).

In total, 4,272 Spotless Starlings were recorded, with the highest number of records obtained in November (>800 ind./km in average; Tab. 1, Fig. 1) and progressively decreasing until to February (differences in AKI are significant comparing these two months: U=19, p=0.03, Mann-Whitney U test). Comparing AKI values among months, the differences tend to be significant (H=6.942, p=0.07; Kruskal-Wallis test for equal medians).

A roosting phenomenon is evident in this town with a strong crowding of starlings in late autumn, even considering that the data must be considered underestimated because they refer to a single sector of the urban center and because the low detectability of birds in urban environments and during the evening hours is known (Fraticelli, 2023; Bibby *et al.*, 2000). We did not

Tab. 1 - Number of Spotless Starlings (*Sturnus unicolor*) recorded during the October 2021-February 2022 period along the four streets (linear transects) in Bonorva (Northern Sardinia, Italy). We reported the number of records (n), the total abundance (Total N), the range of variation (range n), the mean values (mean n, with ± standard deviation), and the mean values of linear density (mean AKI, Abundance Kilometric Index, with standard deviation). In bold, the highest number of records/month. / Numero di storni neri (*Sturnus unicolor*) registrati nel periodo ottobre 2021-febbraio 2022 lungo le quattro strade (transetti lineari) di Bonorva (Sardegna settentrionale, Italia). Abbiamo riportato il numero di segnalazioni (n), l'abbondanza totale (Total N), l'intervallo di variazione (range n), i valori medi (mean n, con ± deviazione standard), e i valori medi della densità lineare (mean AKI, Indice Chilometrico di Abbondanza, con deviazione standard). In grassetto, il numero più alto di segnalazioni/mese.

		Corso Vittorio Emanuele II (n)	Corso Umberto I (n)	Piazza Santa Maria (n)	Via Dante Alighieri (n)	Total N	range n	mean n	mean AKI
2021	29 Oct	**212**	**144**	**88**	**44**	488	44-212	122 (±72.63)	496.33 (±276.66)
	07 Nov	164	368	**222**	72	826	72-412	205.58 (±114.67)	825.55 (±429.08)
	08 Nov	198	**412**	156	74	840			
	09 Nov	**204**	346	167	**84**	801			
	10 Dec	**152**	**188**	**87**	**33**	460	33-188	115 (±68.81)	451.07 (±227.66)
2022	12 Feb	112	**202**	**90**	22	426	22-202	107.13 (69.32)	402.32 (±196.42)
	13 Feb	**154**	189	54	**34**	431			

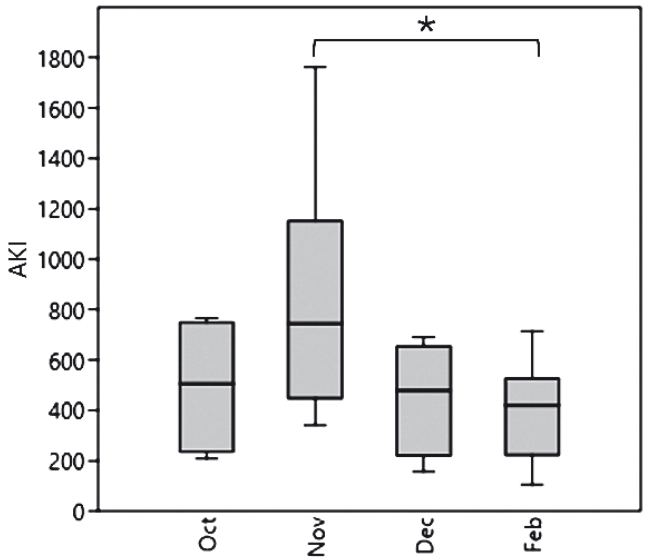

Fig. 1 - Box plots of average number of AKI (Abundance Kilometric Index) of Spotless starlings (*Sturnus unicolor*) in different months (October 2021-February 2022). The minimal and maximal values are shown with short horizontal lines ("whiskers"); 25-75 percentiles are drawn using a box; horizontal line shows the median values. * indicates significant difference ($p<0.05$). / Box plot del numero medio di AKI (Indice Chilometrico di Abbondanza) degli storni neri (*Sturnus unicolor*) nei diversi mesi (ottobre 2021-febbraio 2022). I valori minimi e massimi sono mostrati con brevi linee orizzontali ("baffi"); i percentili 25-75 sono disegnati utilizzando un box; la linea orizzontale mostra i valori mediani. * indica una differenza significativa ($p<0,05$).

observe Spotless Starlings in the trees of the surrounding urban parks: buildings, in the most well-lit and busy streets, appear to represent privileged sites compared to trees (contrary to what is known for the Common Starling; Cignini *et al.*, 1995), at least for small urban towns. This choice may be the consequence of a selection of sites based on the higher ecological suitability of buildings when compared to trees: (i) temperatures may be higher inside the urban settlements, and (ii) some nocturnal predators, such as the Pine Marten, *Martes martes latinorum*, may be absent among buildings but may be present in proximity to trees: this mammal is usually found in forest habitats (Mitchell-Jones *et al*., 1999), but in the southern parts of its distribution area (for example in Sardinia) the species is also present in urban parks (Murgia *et al*., 1995; Colli *et al*., 2011) making the trees less suitable for birds.

Spotless Starling can create local conflicts with citizens as evidenced by social media and websites (e.g., Bua, 2020; Carta, 2023a). Problems include accumulation of guano, transmission of allergens and pathogenic microorganisms, noise from vocalizations even during the night hours. In this regard, mechanical deterrents traditionally used for pigeons have been locally placed on some buildings, designed to prevent these birds from landing along windows and cornices (Haag-Wackernagel & Geigenfeind, 2008). However, as we observed, starlings avoid such deterrents by placing themselves between steel spikes (useful for preventing pigeons from landing, but not effective for this species; Fig. 2): this is also due to their smaller size compared to pigeons and their ability



Fig. 2 - Left: Spotless Starlings (*Sturnus unicolor*) on the facades (cornices, window sills, etc.) of buildings; right: some birds avoiding the steel spikes of anti-perching mechanical deterrents placed on the upper cornice of a window./ A sinistra: storni neri (*Sturnus unicolor*) sulle facciate (cornicioni, davanzali, ecc.) degli edifici; a destra: alcuni uccelli che evitano le punte d'acciaio dei deterrenti meccanici collocati sul cornicione superiore di una finestra. (Photo / Foto: V. Ferri).

to perch on very small surfaces (window frames, electric cables, advertising signs for commercial shops, lock shitters, etc.) where it is difficult or impossible to place these devices.

To reduce the conflict between citizens and Spotless starlings it will be necessary to implement specific solutions using non-lethal deterrence devices to mitigate/prevent these crowding, similarly to those used for Common Starlings in other geographical areas, such as sonic nets and alarm/distress calls (Mahjoub *et al*., 2015; Woods *et al*., 2022; for Italy: Cignini *et al*., 1995), for now applied on Spotless Starlings only in medium-large cities of Sardinia (e.g., Oristano: Carta, 2023b). Other solutions may be represented by magnetic devices to disorient birds (Belant & Ickes, 1997), RobotFalcons and drones (Storms *et al*., 2022), chemical repellents (Tupper *et al*., 2014), appropriated anti-perching wires (Seamans *et al.*, 2007; reviews in Fortuna & Alleva, 1994; Albonetti *et al*., 2020; Klug *et al*., 2023; Micaelo *et al*., 2023). In this latter case, given the ineffectiveness of anti-perching devices, reported in this note, it will be important to modify the distance, density and inclination of the steel tips (originally defined for pigeons) to adapt them to the size and behavior of Spotless Starlings. Further investigation is also needed to analyze the preference for specific types of roosting sites, the heights of roosting sites from the ground, the building orientation, and the role of other local urban parameters.

Acknowledgments

Marco Dinetti provided useful information. Two anonymous reviewers (and Editor) provided useful comments and suggestions.

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