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Urban encounter: First confirmed record of a golden jackal (*Canis aureus*) in Vienna, Austria

Urbane Begegnung: Erster bestätigter Nachweis eines Goldschakals (*Canis aureus*) in Wien, Österreich

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Summary

This study reports the first official record of a golden jackal (*Canis aureus*) in the capital city of Austria, Vienna. The specimen, a young male individual, was discovered as a roadkill in the northern part of the city on January 25th, 2023. It suffered from notable endoparasite and ectoparasite infestations, as well as bacterial pneumonia. Additional field studies with bioacoustic stimulation and the use of a scat detection dog to search for further indications of presence in the area of the accident revealed no further proof of other golden jackals, indicating a high probability of this animal being a disperser in search of a mating partner. This event exemplifies the species' range expansion, driven by a combination of factors. The significance of this discovery and the challenges within the context of mammal research and urban ecology are discussed.

Keywords: mesopredator, canid, roadkill, bioacoustic monitoring, scat detection dogs

Zusammenfassung

Diese Studie berichtet über den ersten offiziellen Nachweis eines Goldschakals (*Canis aureus*) in der österreichischen Hauptstadt Wien. Das Exemplar, ein junges männliches Individuum, wurde am 25. Januar 2023 im nördlichen Teil der Stadt von einem Auto überfahren. Es litt unter Endoparasiten- und Ektoparasitenbefall sowie einer bakteriellen Lungenentzündung. Zusätzliche Feldstudien mit bioakustischer Stimulation und der Einsatz eines Artenspürhundes zur Suche nach weiteren Hinweisen auf die Anwesenheit im Unfallgebiet zeigte keine weiteren Hinweise auf Goldschakalpräsenz, sodass es sich bei diesem Tier mit hoher Wahrscheinlichkeit um einen Durchzügler auf der Suche nach einem Paarungspartner handelt. Dieses Ereignis veranschaulicht die Ausdehnung des Verbreitungsgebiets der Art, die möglicherweise durch eine Kombination von Faktoren, beeinflusst wird. Die Bedeutung dieser Entdeckung und die Herausforderungen im Zusammenhang mit der Säugetierforschung und der Stadtökologie werden erörtert.

Schlagwörter: Mesoprädator, Canide, Strassenfallwild, bioakustisches Monitoring, Naturschutzhunde

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1. Introduction

The golden jackal (*Canis aureus*) is a mesocarnivore species dispersing from its core areas in southeastern Europe and the Balkans (Arnold et al., 2012; Trouwborst et al., 2015). It has shown a range expansion across Europe in recent decades, presumably driven by factors such as changing climatic conditions, agricultural settings, land-use changes, and hunting regimes (Krofel et al., 2017; Spassov and Acosta-Pankov, 2019). While being quite common in Asia or southern and eastern parts of Europe, jackal sightings in urban areas of Central Europe are relatively rare. For instance, in Bratislava (Slovakia), a city with almost 500,000 inhabitants (Správa mesta, 2022), a video captured a disoriented jackal in the city center, near a shopping mall, before its subsequent capture and release into a nearby nature conservation area (N. Guimarães, pers.com.). In Hungary, the first jackal that had been marked with a radio collar in 2006 was caught by a trap in the garden of a house in the city of Baja, a city with approximately 33,000 inhabitants (M. Heltai, pers.com.; Központi Statisztikai Hivatal, 2023a). Also, in 2014, a jackal was caught in a trap in the city of Székesfehérvár, a city with almost 100,000 inhabitants (atv, 2014; Központi Statisztikai Hivatal, 2023b). In the context of the recent dispersal process, these observations suggest a potential emerging pattern of jackal presence in urban environments, specifically in areas that are already surrounded by higher jackal densities, warranting further investigation into their adaptations to live in urban landscapes. Despite the challenge of defining "urban" by different disciplines, here, it is generally seen as a large grouping of people and associated structures comprising at least a town or city (Gehrt et al., 2010).

Vienna, an urban center with diverse natural habitats and over 2 million inhabitants (Stadt Wien, 2024), has now witnessed the first confirmed occurrence of the golden jackal within its city borders. Since the beginning of actively monitoring golden jackals in selected areas of Austria (starting in 2015/2016) and documenting reports of sightings with proof, there have been several reports on their potential occurrences in Austria (Hatlauf, 2022). Sightings within Vienna, however, stayed without any proof or were mistakenly reported red foxes (*Vulpes vulpes*). Within the year 2023, there have been over 160 reports of alleged golden jackals that turned out to be foxes all over Austria. Red foxes are exceptionally adaptable wild carnivores with a wide geographic range, living in diverse habitats from Arctic tundra to deserts and cities. Their urban presence is known and has expanded globally to an estimated 114 cities, including significant populations in the UK, Europe, North America, and Australia (Bateman and Fleming, 2012). Therefore, this golden jackal specimen marks the first scientifically validated record of a golden jackal in Vienna, leaving Vorarlberg as the only province without any official jackal record so far (Table 1). The first discovery details and potential ecological implications of the golden jackal record are presented here.

2. Methods and Results

On January 25th, 2023, a report was received by the *Golden Jackal Project Austria* regarding a potentially road-killed golden jackal (Figure 1) in northern Vienna (Figure 2). This report included a picture, from which a clear C1 category for the animal was possible (Hatlauf and Böcker, 2022). The specimen was already reported to the police, who contacted the ebswien, which is responsible for the correct disposal of road-killed animals. First, it was assessed to be a red fox (which was also the case for the first assessment of the jackal in Bratislava, see above). However, in the end, the dead golden jackal could be recovered before it was disposed of. The recovered specimen was a young adult male golden jackal weighing 11.9 kg.

2.1. Pathologic examination

The postmortem examination of the golden jackal revealed several notable findings. The specimen was in good nutritional condition. However, a severe tick infestation was observed, counting a minimum of 40 ticks (*Dermacentor reticulatus*; Figure 3). Ticks might be important vectors for various pathogens (Duscher et al., 2013; 2014). There was a ruptured

Table 1. Official first records of golden jackals in the Austrian provinces in chronological order
Tabelle 1. Offizielle Erstnachweise von Goldschakalen in den österreichischen Bundesländern in chronologischer Reihenfolge

Province	First Record	Reference
Styria	1987	Bauer and Suchentrunk (1995)
Lower Austria	1988	Hoi-Leitner and Kraus (1989)
Carinthia	1989	Hoi-Leitner and Kraus (1989)
Upper Austria	1990	Aubrecht (1991)
Salzburg	1992	Bauer and Suchentrunk (1995)
Burgenland	1996	Petrakovics (1996)
Tyrol	2019	Hatlauf (2022)
Vienna	2023	This study



Figure 1. Pictures of male golden jackal before the pathologic examination in overview and detail.
Abbildung 1. Männlicher Goldschakal vor der pathologischen Untersuchung in Übersichts- und Detailaufnahmen.

right eye, multiple abrasions on the extremities and testes, and multiple fractures in various skeletal regions, each accompanied by corresponding tissue hemorrhages, confirming the vehicle collision. The lung examination indicated moderate lung hemorrhage, severe lung edema, and a collapsed right lung, characterized by a bluish appearance. The histologic results showed mild neutrophilic and eosinophilic inflammation that was evident in the lung tissue. The heart displayed no abnormalities, while the liver suffered severe trauma. The spleen exhibited moderate follicular swelling with a nodular surface, active follicles, and mild pigment deposits, while the kidneys remained unremarkable. The stomach was empty, and the intestines were well filled. Histologic examination of the intestines revealed an eosinophilic granuloma and further diffuse infiltration with eosinophilic granulocytes and prominent Peyer's patches (lymphatic tissue of the intestine). The lymph nodes, however, displayed no abnormalities. Bacteriologic analysis of lung tissues identified a high-grade presence of *Macrococcus canis* and moderate grades of *Carnobacterium maltaromaticum*, *Escherichia coli,* and *Yersinia enterocolitica* infections. Furthermore, the parasitological examination of intestinal contents revealed a high-grade infestation of *Taenia* and a low-grade infestation of *Toxocara*.

2.2. Fieldwork

Based on three calling stations with repetitions of five howling events at each point (following Giannatos, 2004; adapted in Hatlauf and Hackländer, 2016), there was no answer and it can be assumed that no group was present in the study area. Within 3 days of the roadkill accident, the trained human–dog team (cf. Hatlauf et al., 2021) searched transects of 19.35 km. The team found one track that led directly to the point of the accident, but no scats. Results of the search for indications of golden jackal presence in the area revealed no further hard facts. Looking at the surrounding areas outside of Vienna, there have been a minimum of five confirmed records within the past 20 years that happened close to the city and were reported within a 15-km radius (Figure 2).

3. Discussion and Conclusion

Urban areas have become increasingly important for carnivore conservation and management due to the loss of natural habitats (Streicher et al., 2023). For some species, it can serve

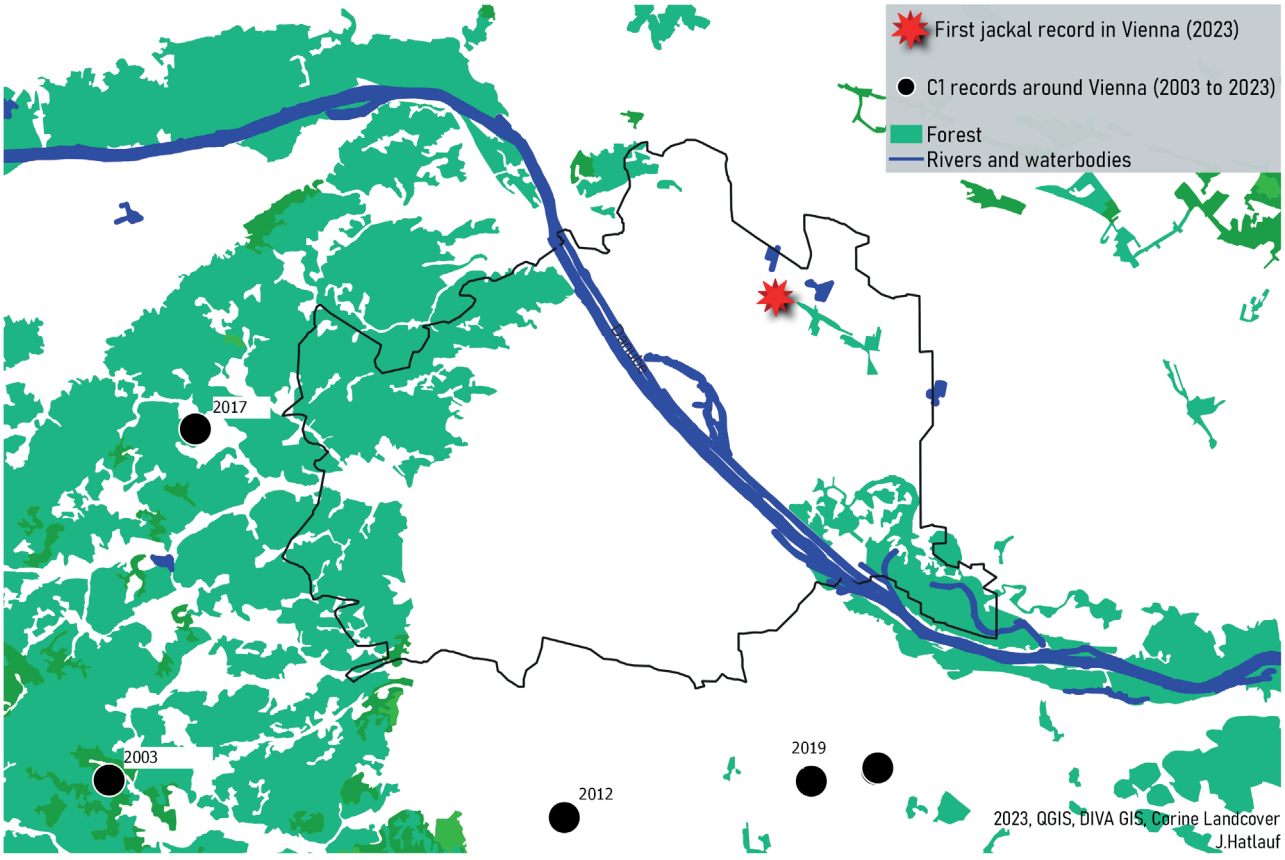

Figure 2. Location of the first confirmed road-killed golden jackal in Vienna (red sign) and the closest (up to 15 km to the border of Vienna) confirmed records (C1 categorized after Hatlauf and Böcker, 2022) in the past 20 years (black dots).
Abbildung 2. Ort des Fundes des überfahrenen ersten bestätigten Goldschakals in Wien (rotes Zeichen) und die nächstgelegenen (bis zu 15 km zur Wiener Stadtgrenze) bestätigten Nachweise (C1 Kategorisierung nach Hatlauf und Böcker, 2022) der letzten 20 Jahre (schwarze Punkte).

as a sink, while for others, it may serve as a refuge (Gehrt et al., 2010; Streicher et al., 2023). These environments can pose challenges for mammals, including limited vegetation, fragmented habitats, or mostly abundant and dense network of roads that might serve as barriers in their expansion process. High food and water availability in urban habitats, coupled with protection from other predators – wolves (*Canis lupus*) in the case of golden jackals (Krofel et al., 2017) – might increase the growth rate, survival, and population densities of carnivores and improve their body condition (Bateman and Fleming, 2012). A future adaptation of the golden jackal to urban environments outside their previous core areas might show challenges and benefits similar to other medium-sized carnivores such as the red fox, coyote (*Canis latrans*), Eurasian badger (*Meles meles*), and raccoon (*Procyon lotor*) (Gehrt et al., 2010; 2023). Despite these challenges, golden jackals have shown a remarkable ability to thrive in rural settings where food is abundant and habitat structures divers (Šálek et al., 2014). They are adept at exploiting anthropogenic food sources, such as garbage and waste from human activities (Cirovic et al., 2016), providing them with a reliable and abundant food supply. This availability of food, coupled with the use of urban structures for shelter, might even lead to higher population densities closer to cities. The urban landscape may also inhabit fewer natural predators, contributing to safer breeding conditions and potentially higher survival rates (but also more stress, like it has been shown for coyotes; Gehrt et al., 2023). However, these assumptions still remain unconfirmed in Austria, where mostly natural and protected areas have shown jackal group occurrence so far (Hatlauf, 2022).

The presence of golden jackals in urban areas can lead to complex topics. Interactions with humans can lead to conflicts (Shome et al., 2023), including public health concerns



Figure 3. Ticks (*Dermacentor reticulatus*) trying to leave the dead individual.
Abbildung 3. Zecken (*Dermacentor reticulatus*), während sie das tote Individuum verlassen.

due to the potential transmission of diseases or incidents of road accidents. Moreover, dependence on human-provided food sources can alter their natural foraging behaviors and dietary habits (Cirovic et al., 2016). Relatives of golden jackals, the coyotes, display remarkable behavioral, social, and dietary plasticity, allowing them to not only exploit but also thrive in various human-modified environments. The recent increase in urban coyote populations, especially in midwestern and eastern North American cities, has highlighted their adaptation to urban environments (Bateman and Fleming, 2012; Gehrt et al., 2023). Understanding how golden jackals can adapt to and interact with the urban ecosystem will be important for wildlife management and conservation, particularly in the context of environmental changes. A standardized and correct assessment (Hatlauf and Böcker, 2022) and the ability to identify yet rare species in new environments are becoming essential. For responsible personnel in Vienna, like the waste and roadkill dispersal employees, a feasible reporting system is becoming relevant. Furthermore, training on species recognition and, consequently, categorization of records (Hatlauf and Böcker, 2022) would be most welcome for conservation, research, and monitoring of not only the species, but also of zoonoses and parasites. The studied golden jackal individual suffered from high endoparasite and ectoparasite infestations, as well as bacterial pneumonia, important factors affecting the health and well-being of wildlife populations and highlighting the significance of postmortem examinations. Further research is warranted to, firstly, study the broader implications of potential zoonoses of this quickly expanding species in our human-dominated ecosystems across Europe (Veronesi et al., 2023) and, secondly, study a potentially higher or lower prevalence of infestations in single wandering dispersers compared to group living (and therefore more grooming) individuals (Moore, 2002)

In conclusion, the first confirmed record of a golden jackal in Vienna represents a noteworthy event in mammal research and urban ecology. While there has not been any proof of resident golden jackals in Vienna yet, the city's mosaic of habitats, including national park areas and the extensive Vienna Woods, can potentially provide various refuge and hiding options for them in the future. Furthermore, this discovery emphasizes the importance of ongoing research efforts to understand the ecological implications of the golden jackals' range expansion and their dispersal. Given their dynamic spread across Europe, collaborative research efforts with colleagues from neighboring regions are essential to comprehensively address implications for populations in urban settings.

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