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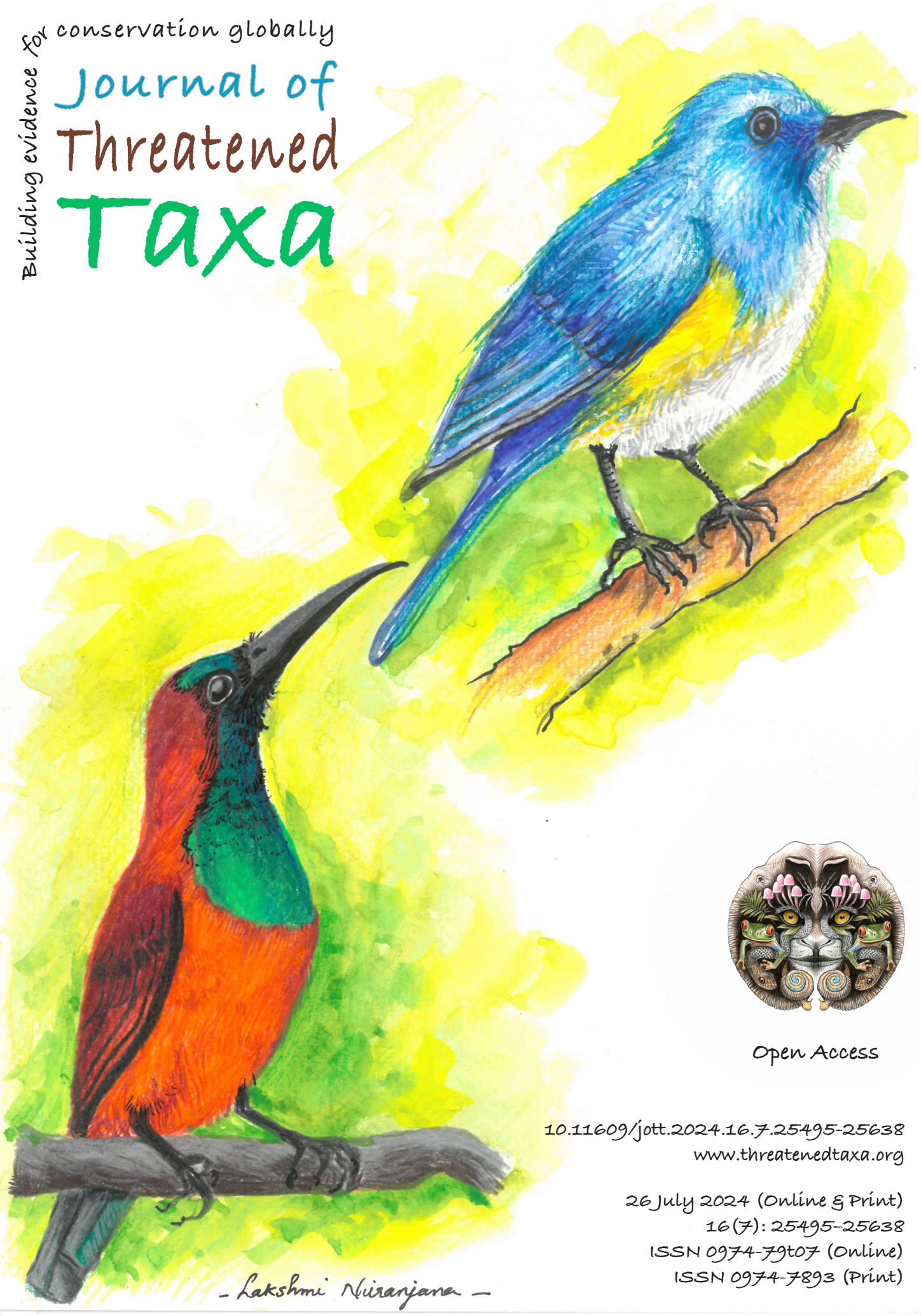

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Cover: Mixed media illustration of a Blue bird and Sunbird. © Lakshmi Niranjana.

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COMMUNICATION

Small Wild Cats Special Series

Rare encounters: Jungle Cat *Felis chaus* Schreber, 1777 (Mammalia: Carnivora: Felidae) in the lower reaches of the Jordan River, Jordan

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Abstract: The Jungle Cat *Felis chaus* is classified as critically endangered in Jordan due to its limited distribution and presumed population decline. We present new evidence for its presence in the lower Jordan River region, where it was recorded opportunistically during a monitoring program focused on the Golden Jackal *Canis aureus*. Five photographs of the Jungle Cat were obtained between June 2020 and February 2022, primarily during night-time and early morning hours. In view of these findings, we recommend urgent implementation of conservation measures, including other effective area-based conservation measures, particularly in military-controlled zones with limited accessibility where confirmed sightings occurred.

Keywords: Bycatch, camera trap, citizen science, habitats suitability, human-induced threats, northern ghor, other effective conservation measures, private farms, riverbed, threatened species.

تم تصنيف قط الغابات في الأردن كنوع مهدد بالانقراض بشكل حرج نظراً لتوزيعه الجغرافي المحدود والانخفاض المحتمل في أعداد جموعه. نقدم في هذا البحث أدلة جديدة تثبت وجود هذا النوع في المناطق السفلية من نهر الأردن، حيث تم تصويره بشكل انتهازي خلال برنامج مراقبة لحيوانات ابن آوى. تم التقاط خمس صور لقط الغابات في ساعات الليل والصباح الباكر في الفترة الواقعة ما بين شهر حزيران للعام 2020 وشهر شباط من العام 2022. في ضوء هذه النتائج، نوصي بتطبيق تدابير عاجلة أخرى لحماية المناطق بفعالية، لا سيما تلك المناطق التي تخضع لإدارة القوات المسلحة الأردنية والتي توفر ملاذات للأنواع لمحدودية إمكانية الوصول إليها.

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Author contributions: E.E and M.F.A participated in research design and data collection. E.E. analyzed data and wrote the manuscript. E.E and M.F.A reviewed the article and gave final approval for publication.

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INTRODUCTION

Consensus across various red list assessments indicates a decline in the Jungle Cat *Felis chaus* population at national, regional, and global levels, in addition to the paucity of available information. It has been assessed as Least Concern on the IUCN Red List, and the global population is thought to be declining (Gray et al. 2016). However, regional assessments in West Asia vary. It is classified as Data Deficient in the Mediterranean Region and the Arabian Peninsula (Temple & Cuttelod 2009; Jdeidi et al. 2010; Mallon et al. 2023), but Critically Endangered in Jordan due to limited occupancy and presumed population decline (Eid et al. 2020).

The Jungle Cat is distributed across a wide range, from the Anatolian region in Turkey (Gerngross 2014; Ünal & Eryilmaz 2020) southward to the Nile River valley in Egypt (Basuony 2000). In the Levant, it occurs in southern Lebanon, Palestine and western Jordan (Qumsiyeh 1996; Amr 2000; Tohme & Tohme 2000). To the east of the Levant, its range extends to the Euphrates and Tigris Rivers in Syria and Iraq (Masseti 2009; Al-Zubaidi et al. 2017; Mallon et al. 2023), the Iranian Plateau and the Caucasus (Sanei et al. 2016; Askerov et al. 2022) to central, southern, and southeastern Asia (Gray et al. 2016).

The Jungle Cat is considered rare in Jordan, with a limited distribution mainly confined to the country's northwestern region (Eid et al. 2020). Information about it is scarce, possibly due to restricted access to the Jordan River, designated as a military zone with limited access for people (Abu Baker et al. 2003). The only known records are two deceased specimens found on 10 February 1998 in Al–Baqurah within the Yarmouk River Valley (Abu Baker et al. 2003; Eid et al. 2020). Since then, there have been no further records on its status or potential distribution in Jordan. Abu Baker et al. (2003) suggested that its range might extend to the lower regions of the Jordan River and its main tributaries.

Here we report photographic evidence of the continued presence of the Jungle Cat in Jordan obtained during a monitoring survey targeting the Golden Jackal *Canis aureus* in northwestern Jordan.

Study area

Our survey was conducted in the lower reaches of the Jordan River between the Sea of Galilee and the Dead Sea in Jordan (Ibrahim et al. 1976; Katz 2022). The study area encompassed a 9.9 ha private farm in Sheikh Hussein, northern Ghor (Figure 1), cultivating citrus varieties using irrigation, fertilization, and herbicide control. The farm boundaries extend to the Jordan River, and the farm's landscape features riparian vegetation dominated by Common Reed *Phragmites communis*, Cattail *Typha domingensis,* and Athel Tree *Tamarix aphylla*. Additionally, various shrubs and herbs thrive, including Sieber's Wormwood *Artemisia sieberi*, Christ's Thorn Jujube *Ziziphus spina-christi*, Arabian Fagonia *Fagonia arabica,* and Common Mallow *Malva sylvestris*. The farm serves as a sanctuary for migratory birds such as ducks, herons, egrets and storks. Despite this, the dense reed may pose a fire hazard, prompting farmers to actively manage it through removal, controlled burning or herbicide application to maintain a sustainable farming environment.

MATERIALS AND METHODS

We deployed four Dark Ops HD MAX Browning camera traps that were set to a trigger speed of 0.6 seconds with a trigger delay of one second. The cameras were active for 24 hours at the same locations during the entire study period and were checked monthly. They were fastened to iron sticks anchored in the riverbed and positioned approximately 40–50 cm above ground in both south and north directions to avoid false records during sunrise and sunset. No bait was used to ensure neutral data collection. Their locations were determined using a Garmin eTrex 20x device set to datum WGS84.

RESULTS

Our total survey effort covered 2,548 camera trap days at four locations from 1 June 2020 to 28 February 2022. We obtained five photographs of solitary Jungle Cats at all four camera trap locations. Four records occurred during late-night or early-morning hours and one in the afternoon. In 2021, the Jungle Cat was photographed on 12 January at 1258 h, 17 January at 2133 h, 11 April at 2135 h, and 3 September at 2241 h. The only record in 2022 occurred on 30 January at 0212 h (Image 1).

During the survey, several other species were recorded, including the Golden Jackal *Canis aureus*, Egyptian Mongoose *Herpestes ichneumon*, Wild Boar *Sus scrofa*, Red Fox *Vulpes vulpes*, various rodent and numerous bird species.

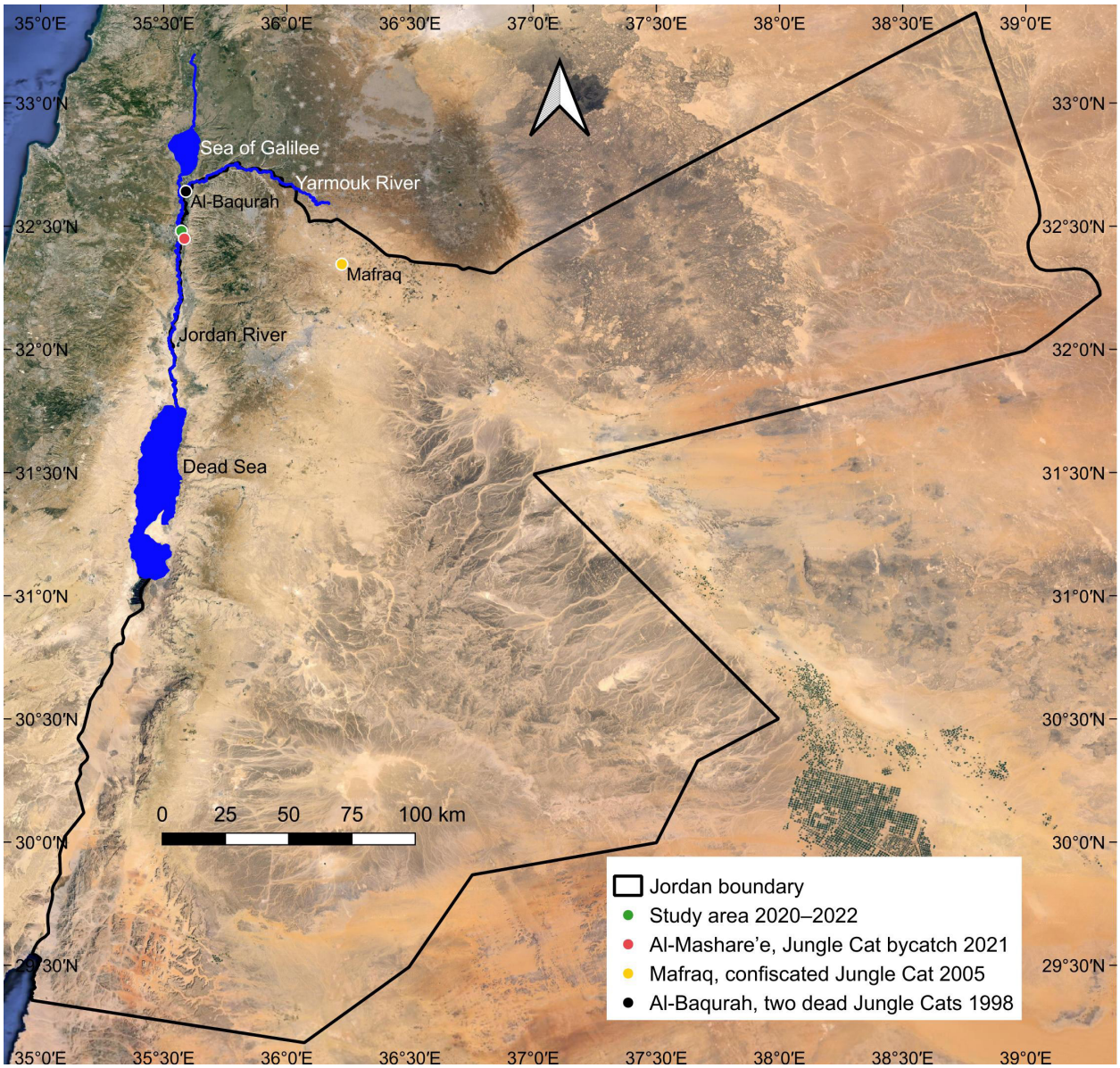

Figure 1. Map showing study area and locations where Jungle Cats were encountered between February 1998 and January 2022 in Jordan.

DISCUSSION

Our survey is the first camera-trapping study in the Jordan River basin. Our results confirm the continued presence of the Jungle Cat in the lower reaches of the Jordan River nearly 22 years after two dead specimens were found near the Yarmouk River, a tributary of the Jordan River (Abu Baker et al. 2003). However, the limited number of photographs did not allow to determine the number of individuals in our study area.

We consider the agricultural setting of our study area and its surroundings to represent a suitable habitat for the Jungle Cat. Thick and dense riparian vegetation along riverbeds has been suggested to provide ideal hiding and movement spaces (Abu Baker et al. 2003; Masseti 2009; Sanei et al. 2016; Eid et al. 2020; Mishra et al. 2020; Desai et al. 2022). As documented by our survey, the area also hosts abundant rodents, which constitute the most important prey items of the Jungle Cat (Mukherjee et al. 2004; Majumder et al. 2011; Rostro-García et al. 2021).

The camera traps frequently documented four feral dogs *Canis familiaris* on the farm, which the owner kept after rescuing them. Despite more than 18 months of study duration, the Jungle Cat was recorded rather infrequently. The low detection rate can be attributed to the dense growth of reed plants, which significantly hindered visibility, affected the quality of photographs

Image 1. Jungle Cats photographed in the study area between 12 January 2021 and 30 January 2022. © Ehab Eid.

and resulted in numerous photographs of plants swaying in the wind. This situation required considerable effort to repeatedly remove reed growth. Active agricultural operations of workers, roaming feral dogs, Golden Jackals and other wildlife using the same habitat day and night added complexity to the recording environment. However, this challenging setting might also benefit the Jungle Cats, allowing them to manoeuvre quietly through dense vegetation (Abu Baker et al. 2003) and avoid encounters with humans, feral dogs and other competitors. The low detection rate of the Jungle Cat can also be attributed to the exceedingly small population within our study area and its surroundings.

We identified several human-induced threats to the Jungle Cat population, consistent with findings by other scholars (Abu Baker et al. 2003; Eid et al. 2020, 2022). These threats include habitat alteration, fragmentation and degradation due to agricultural expansion,

the burning of wetland reeds, prey depletion from widespread pesticide use, and bycatch. An incident of bycatch involved the capture of an adult Jungle Cat in November 2021 in the Al-Mashare'e area, approximately 6 km south of our study area. The cat was caught in a net intended for chicken protection but escaped after being video-recorded. Further investigations using citizen science may reveal more instances of accidental or incidental hunting of the Jungle Cat, potentially challenging literature that suggests no hunting of this species occurs in Jordan (Abu Baker et al. 2003; Eid & Handal 2018). Elsewhere in its range, the Jungle Cat is threatened by the conversion of natural wetlands to agricultural lands, excessive destruction and burning of reeds, pollution due to extensive pesticide use, and poaching (Ogurlu et al. 2010; Gray et al. 2016; Sanei et al. 2016; Barkat et al. 2021).

Furthermore, the restricted niche where wild and domestic species coexist exacerbates the threat to the Jungle Cat. This was confirmed through species distribution models assessing suitable habitats for the Jungle Cat in Jordan, which revealed a significant decline in these habitats. Projections indicate a 33% reduction by 2050 and a staggering loss of 90% by 2070 under the Representative Concentration Pathways (RCP) 2.6 scenario. Even under the RCP 8.5 scenario, an 84% habitat loss is forecasted by 2070 (Eid et al. 2022). These alarming trends emphasize the need for conservation efforts to protect the Jungle Cat from extinction. It was not documented in Jordan's trade or folk medicine (Eid et al. 2011; Aloufi & Eid 2016). A single individual, claimed to be brought from Syria, was confiscated at a private farm in Mafraq city in eastern Jordan in 2005 (Ehab Eid, unpublished data).

The designation of Yarmouk protected area in 2010 in the Yarmouk River valley and the military control of border areas may be beneficial for the conservation of the Jungle Cat, in view of historical records of dead specimens in this area (Abu Baker et al. 2003). No sightings have been recorded within the protected area to date (Sufian Al-Yahya, pers. comm. 3 February 2024). This absence of sightings may be due to restricted site access or limited survey efforts. Therefore, targeted research and collaboration with the military are essential to determine the Jungle Cat's status.

Despite the Jungle Cat being listed in Appendix I of the Wildlife Protection of the Agricultural Law Number 13 of 2015, based on Regulation Number 43 of 2008, enforcing these legal instruments in Jordan is ineffective. Mitigating threats and preventing species extinction requires a thorough review and development of the legal framework associated with effective implementation.

The Jungle Cat's presence within this limited access protected zone underscores the critical need for targeted conservation measures. The Jordanian government, particularly the Ministry of Environment and conservation organizations such as the Royal Society for the Conservation of Nature, should explore establishing Other Effective Area-Based Conservation Measures (OECMs). Farhadinia et al. (2022) recommended this approach to meet post-2020 biodiversity targets in Asia, noting that achieving the ambitious 2030 goal requires a substantial increase in protected area coverage. Currently, the riverbeds of the Yarmouk and Jordan Rivers are under army protection, presenting a valuable opportunity for species and habitat conservation and implementing OECMs, especially in view of the area's limited accessibility. Specifically, implementing OECMs through strategic partnerships with military units along the Yarmouk and Jordan rivers is essential to safeguard the Jungle Cat population and prevent its potential extinction in Jordan.

The results of this study are highly significant as they pave the way for further research into the status of the Jungle Cat across the entire Jordan River basin and its tributaries, extending northward to include the Yarmouk River. Establishing effective communication and collaboration with military units will facilitate and support the implementation of surveys. Regional cooperation with the West Bank in Palestine and southeastern Syria adjacent to the Yarmouk River valley is crucial, as it will likely yield important insights into the Jungle Cat's status and habitat use. Understanding the regional context will aid conservation efforts, particularly during species Red Listing and considering the rescue effect. These findings highlight the need for a coordinated approach to wildlife management and conservation, enhancing our understanding and enabling more effective protection measures for the Jungle Cat.

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