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A Call to Protect Common Species: Bats as a Case Study

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ABSTRACT

The ongoing biodiversity crisis highlights the need for targeted conservation efforts, yet the focus often remains on rare and endangered species. This overlooks the vital role of common species, which are the ecological backbone of ecosystems, supporting the stability and functioning of biodiversity. We argue that common species, especially their population dynamics and potential tipping points, are too often neglected and that their conservation is urgent. We illustrate this issue using bats (Chiroptera) as a model. This diverse mammalian order features key ecosystem service providers, including insectivores, pollinators, and seed dispersers. Bats are sensitive to anthropogenic pressures, and many species, including common ones, face population declines and the impact of ecosystem disruption. Research and conservation must urgently be expanded to include common species. Through case studies, we demonstrate how common bat species are indicators of environmental changes and the urgent need to monitor their populations. We provide recommendations for improving research, enhancing conservation policies, and adopting a more inclusive framework acknowledging the indispensable role of common species in ecosystem services and biodiversity.

1 | Introduction

Life on our planet is threatened. This is starkly illustrated by the WWF's most recent Living Planet report (https://livingplanet.panda.org/), showing a 73% decrease in monitored wildlife populations over the past 50 years. The 2030 global goals will not be met, and the traditional focus on rare and endemic species is insufficient.

Although much of our planet's biodiversity consists of rare, specialized species, ecosystem functions mostly depend on abundant generalists (Gaston 2010; Winfree et al. 2015). Common species are crucial in shaping large-scale spatial patterns of species richness among animals and plants (Pearman and Weber 2007). We are slithering toward many irreversible ecological tipping points, several of which may be driven by the unnoticed decline of common species. Yet studies addressing these risks are relatively rare, biased toward aquatic systems, and focused on short-term effects (Hernández Martínez de la Riva et al. 2023).

Common and rare species share many anthropogenic threats. Reactions may vary depending on species and habitat, with common species often being more resilient; yet, even seemingly abundant species can decline suddenly and rapidly in response (Gaston 2010). Conservation should extend beyond rare or endangered species to include common ones. Limited funding often requires prioritization, leaving common species inadequately protected (Lindenmayer et al. 2011). As umbrella species are often rare and show different habitat preferences, they offer limited protection to common species.

The extinction of the North American passenger pigeon, once the Earth's most abundant bird, illustrates how quickly common species can vanish. Within a few decades, relentless hunting and Allee effects caused the pigeon's population to collapse, disrupting forest regeneration and nutrient cycling at continental scales; the species was declared extinct in 1914, when the last captive individual died (Fuller 2015). The effect of the loss of a single species on ecosystems has been evaluated for birds but rarely for mammals. These vertebrates, including common species, perform underestimated key functions in ecosystem dynamics as staple prey, keystone predators, pollinators, seed dispersers, and even carbon storage contributors (Schmitz et al. 2023).

Bats exemplify the importance of common species and the threats they face. They are the second-largest mammalian order, with 1487 currently described species (https://batnames.org/). Bats have a nearly global distribution and deliver essential ecosystem services as pollinators, seed dispersers, and arthropod predators (Tuneu-Corral et al. 2023). These mammals are sensitive to human action, including habitat change, pesticides, agricultural intensification, wind turbine and vehicle collisions, predation by invasive species like free-ranging domestic cats, hunting, and climate change (Frick et al. 2020). Substantial data gaps exist on bat presence, distribution, ecology, and population trends (https://www.iucnredlist.org/).

Many bat populations are globally decreasing, with 15% of the species globally listed as threatened by the IUCN, an additional 18% as data deficient, and a staggering 57% having unknown population trends (Frick et al. 2020). In the EU, the 92/43/EEC Habitats Directive lists all bat species as of community importance, with 13 species (ca. 29%) requiring Special Areas of Conservation. Protection efforts for bats have been expanding in Europe (UNEP EUROBATS agreement) and in many other regions. Numerous initiatives, including LIFE+ projects in the EU and research and management actions in protected areas, are increasingly targeting bat conservation. However, although the EU Habitats Directive protects all bats, with special measures for some species (Directive's Annex II), common species, protected on paper, are often neglected.

While previous studies have stressed the ecological importance of common species (Gaston 2010) and demonstrated their disproportionate role in ecosystem service provision (Winfree et al. 2015), these insights have remained largely conceptual or focused on single-species case studies (e.g., Frimpong 2018 on freshwater fish). We now systematically apply this framework to bats—an exceptionally large, diverse, globally distributed, and ecologically flexible group delivering essential ecosystem services. Bats offer a powerful model for understanding how common species underpin ecological stability but remain vulnerable to converging threats such as habitat loss, ecological traps, climate change, and persecution. We also synthesize a broader set of overlooked risks—disease-driven public fear, pesticide-induced ecosystem disruptions, and climate-induced mass mortalities—into a cohesive argument for urgent conservation. Even where formal policy exists, conservation efforts remain biased toward rare species, exposing a gap between legal protection and actual implementation. Our study addresses this gap by linking behavioral, ecological, and policy dimensions, reframing the role of bats in the conservation debate. It offers a transferable approach for re-evaluating the role and vulnerability of common species more broadly. In doing so, we provide both a conceptual advance and a policy-relevant foundation for integrating common species into mainstream conservation frameworks.

2 | "Common" Bat Species and Why They Matter

Only relatively few bat species are "common." Common bat species can reach astonishing population sizes, forming some of Earth's most visually striking wildlife aggregations. For example, Mexican free-tailed bats (*Tadarida brasiliensis*) in the Southern US or wrinkle-lipped free-tailed bats (*Chaerephon plicata*) in Malaysia form immense cave colonies, exceeding one to two million individuals (Hristov et al. 2010), and over one million straw-colored fruit bats (*Eidolon helvum*) roost within a single hectare of forest in Zambia (Koger et al. 2023; Figure 1). These extraordinary gatherings underscore how common bat species dominate certain landscapes, shaping ecosystems through their sheer numbers. These common species also deliver important cultural ecosystem services, including bat watching (Tanalgo and Hughes 2021) and provide unique citizen science opportunities (Greving et al. 2022).

Common bat species are widespread and abundant, occurring in many habitats, from forests and semi-natural areas to human-modified landscapes. Although many thrive in agroecosystems and urban environments, commonness does not equal synanthropy, as several ecologically significant species are abundant but not urban-dwelling. Even synanthropic species—often common—occur across many habitats, including natural ones. Urban environments act as ecological filters, favoring flexible and opportunistic species. The traits of urban species can therefore illustrate life-history characteristics associated with success under anthropogenic pressure. Urban bats tend to have relatively larger brains—a trait linked to behavioral flexibility—likely reflecting selection for individuals able to cope with unpredictability (Wolf et al. 2022). They also show larger litter sizes (more frequent twin litters), lower frequency echolocation calls (better suited to open, less cluttered spaces), and flexible roost selection (Wolf et al. 2022). Many common bat species are opportunistic feeders with broad diets and tend to tolerate anthropogenic stressors such as artificial light, which they may even exploit to feed on insects it attracts (Cohen et al. 2020; Salinas-Ramos et al. 2021).

From a conservation perspective, the IUCN Red List assesses common species as Least Concern (LC). However, many such species are in decline or have unknown population trends. Common species may possess unique genetic profiles and adaptive potential, making their conservation crucial for maintaining genetic diversity or evolutionary potential, and they may even contain two or more cryptic species. Although rare species are often considered better ecological indicators due to their association with specific environmental conditions, common species can also be valuable, for example, reflecting shifts in forest management, river functionality and quality, or climate change—reviewed in Russo et al. (2021).

Common species are also important ecosystem service providers. Bats are key mammalian pollinators (Ratto et al. 2018), a service

FIGURE 1 | Thousands of *Eidolon helvum* take flight at dusk over Kasanka National Park, Zambia. Will spectacles like this soon disappear? *Source:* Image courtesy of Christian Ziegler.

heavily threatened by climate change (Zamora-Gutierrez et al. 2021). Bat-mediated seed dispersal is crucial for forest regeneration and holds significant economic value (van Toor et al. 2019). Insectivorous bats prey on many arthropods, including those damaging crops and forests and threatening human health (Tuneu-Corral et al. 2023). Large populations of abundant species are essential for delivering key ecosystem services, such as pest suppression (Winfree et al. 2015). For example, the white-nose syndrome, which has killed millions of bats in North America, has reduced insect predation, leading to increased pesticide use and, in turn, a rise in human infant mortality (Frank 2024). Another important aspect of pest control is the ability of bats to shift their feeding behavior in response to sudden outbreaks of arthropod pests. Migratory bats moving in can control locally abundant pest insects that resident predators cannot manage (McCracken et al. 2012). Although migration is infrequent in bats, several migratory insectivores are common and can move where a seasonal explosion of food availability occurs. Similarly, the seasonal fruit pulse in the African savannah may lead to the migration of a top seed disperser, *E. helvum*, which follows the green wave of food availability (Hurme et al. 2022). Land use changes, deforestation, and climate change especially impact migratory bats, leading them to alter, shorten, or even abandon their migrations altogether. The Convention for Migratory Species (https://www.cms.int/) recognizes migratory species as particularly vulnerable, yet protective measures are rarely implemented.

3 | Common, Common, Gone

The sad tale of the Christmas Island pipistrelle (*Pipistrellus murrayi*) exemplifies how even once-abundant species can vanish when timely conservation measures are not implemented (Woinarski 2018). Considered common, this bat dramatically declined in the early 1990s. By the late 1990s, the decline accelerated, and the species was last detected in 2009 despite last-minute conservation attempts.

Common bat species face unique and significant threats (Figure 2). Urbanization and agricultural expansion have created ecological traps for species living in cities and farmland (Russo et al. 2024). Urban-dwelling bats are often subjected to roost eviction as habitats are destroyed or redeveloped, whereas direct persecution by humans, viewing bats as pests, is ongoing (Voigt et al. 2016). Bats forming large colonies, particularly those roosting in human-made structures, such as barns, churches, and attics, face additional risks. Human interference makes these colonies highly vulnerable to disturbance, leading to catastrophic population losses (Voigt et al. 2016). Disturbances at this scale threaten bat population stability and the broader ecological processes bats support.

Pesticide use in farmland poses a serious risk, directly harming bats through exposure and biomagnification and reducing their food supply by depleting insect prey (Frank 2024). Additionally, wind turbines have become a growing hazard, particularly for migratory species, killed annually by the 100,000s during their nocturnal flights. The common noctule (*Nyctalus noctula*), one of several species with unknown population trends, exemplifies how these losses can be unsustainable, even when the remaining populations are large (Figure 2). Similarly, common fruit bats such as *E. helvum* are targeted by netting to protect crops or hunted for food, further exacerbating their decline (Figure 2). At least 128,000 *E. helvum* are sold annually in Ghana—more than the country's largest known colony (Kamins et al. 2011).

Common bat species are particularly vulnerable to persecution, as their abundance makes them more visible and accessible to misguided eradication efforts. The recent emphasis on bats' role in disease transmission—often exaggerated by scientific publications and the media—has heightened public fear, leading to increased targeting of these species. Although bats are reservoirs

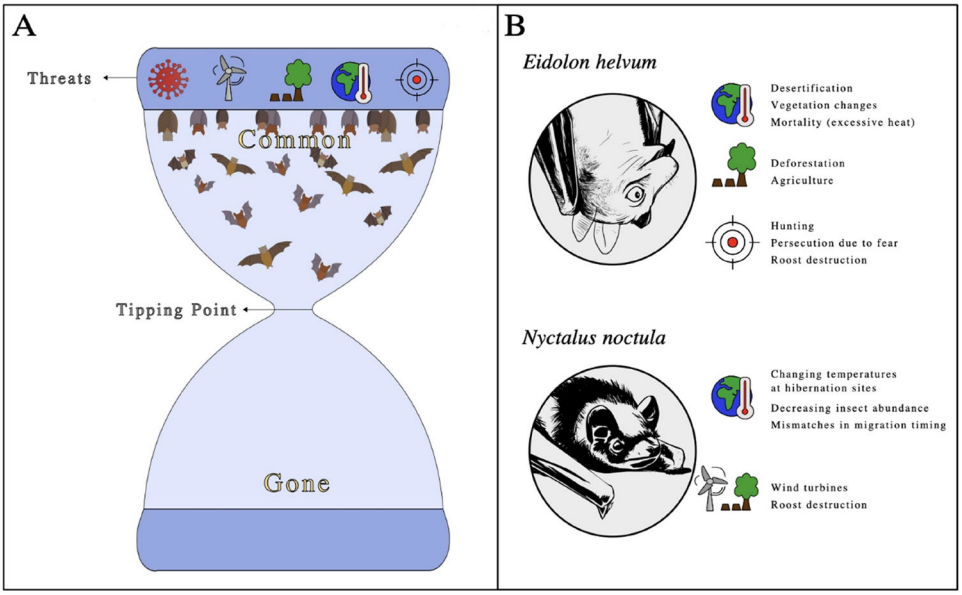

FIGURE 2 | (A) An hourglass illustration depicting the decline of common bats. The upper half, filled with bats, represents pre-tipping point populations, whereas the empty lower half symbolizes the point of no return. The bottleneck, marked as a tipping point, highlights a critical threshold, potentially even at a high remaining population size, beyond which declines may become irreversible. The same major threats affect bat species worldwide: diseases, habitat destruction and degradation, climate change, hunting, and persecution (as indicated at the top of the hourglass). Such factors continue to push bat populations toward unsustainable declines. Without urgent conservation action, even once-abundant species may face irreversible losses. (B) Two case studies, *Eidolon helvum* and *Nyctalus noctula*, illustrate species-specific threats within the broader threat categories. Wind turbines are a known threat to *N. noctula*, but no data exist for *E. helvum*. *Source:* (A) https://livingplanet.panda.org/.

for certain pathogens, perceiving them as primary sources of disease overlooks the broader issue of human-induced habitat encroachment. The disruption of natural ecosystems, not bats themselves, increases the risk of zoonotic disease transmission by intensifying human–wildlife interactions (Rocha et al. 2021). Another emerging threat affecting even common bat species is climate change. Extreme weather events, such as heat waves, are causing mass mortalities, with fruit bats and common urban species falling from their roosts due to overheating. Changes can vary from range shifts to morphological and physiological responses, but more empirical work is needed (Festa et al. 2023).

4 | Research on Common Bat Species: Urgently Needed but Overlooked

Research funds are often directed toward rare species. Although this is undeniably important, research on common species is severely underfunded (Lindenmeyer et al. 2011). Common species play pivotal ecological roles (Gaston 2010), and research is needed to enhance their services, use them as bioindicators, and monitor their populations within a One Health framework (Aziz et al. 2020). Investigating common bats can identify ways to mitigate conflict with humans, such as roosting in urban areas or interfering with agriculture by fruit-eating species.

Knowing species' abundance—a type of information rarely available for bats—is key to research and conservation decisions (van Toor et al. 2019). Understanding past population sizes and trends is essential for determining whether species require protected status. Standardized, well-planned long-term monitoring is important because many bats seasonally move between roosts. Depending on the timing of the count, this movement can lead to over- or underestimates of population size. However, such counts can also provide valuable insights into these seasonal movements. For example, year-round counts by volunteers of straw-colored fruit bats have demonstrated the importance of colony size for accurately timing migratory movements in response to local food availability (Hurme et al. 2022). Losing a single large colony could trigger devastating Allee effects, much like the catastrophic decline and eventual extinction experienced by the passenger pigeon. Likewise, protecting key roosts, such as North America's major colonies of Brazilian free-tailed bats (Hristov et al. 2010), may not be sufficient if these migratory bats continue to face other threats along their routes.

Currently, the bats' small size prevents the use of long-term tracking technology, limiting our ability to track their movements for effective conservation planning. Developing accurate methods for counting and tracking bat populations over time is essential for maintaining the health of our biosphere. The acoustic monitoring of bat echolocation calls is easily accessible and broadly used for species diversity surveys, and long-term monitoring is ongoing in North America and some European countries. Although accurate counts via acoustics are difficult, acoustic data can still demonstrate relative changes in abundance. Methods to estimate bat populations from roost counts use thermal, near-infrared, and visual spectrum cameras combined with software for automated counts (e.g., Hristov et al. 2010; Koger et al. 2023). These technologies are still being refined and require substantial effort, particularly for image and video analysis. Ongoing advances in artificial intelligence and automated detection systems, applied to livestock monitoring, drone surveys, and camera trap data, are expected to make such tools

increasingly accessible, including for citizen science applications, as the urgency for accurate monitoring grows. However, while useful, roost counts may be misleading for species that frequently switch roosts, so a complementary approach combining multiple methods, including acoustic monitoring, is desirable.

Caves and other roosts are key to preserving common bat species. They often harbor large percentages of regional populations and may also help identify landscapes with remaining suitable habitat. Such sites make systematic monitoring possible, not only of overall numbers but also of reproductive timing and other life history stages, birth and fledging rates, sex ratios, and so forth. Major roosts are often exposed to threats such as persecution or hunting, making them key for conservation efforts. Therefore, identifying such exceptional sites has key legal implications for site protection.

Studying common species also offers insights into traits that may explain the vulnerability of rarer ones. Comparing their ecology and behavior can reveal why some species persist under human pressure, whereas others decline. Common species offer an excellent opportunity to study gradients of genetic flexibility and adaptive potential due to their broad distribution. These species occupy diverse habitats and are subjected to varying environmental pressures, which provides a unique opportunity to investigate how they adapt across different contexts. This information is invaluable for understanding how animal communities, including bats, may respond to large-scale environmental changes. It can also provide clues about the potential for adaptation in threatened species, guiding conservation efforts to help them cope with the changing world.

5 | Conclusions

Neglecting common species is an ongoing oversight in conservation biology, with far-reaching implications for biodiversity and ecosystem services, not only for bats. Common species play vital roles in their ecosystems, yet assuming they are immune to decline is a dangerous misconception. The rapid passenger pigeon's and Christmas Island pipistrelle's extinctions highlight how seemingly abundant species can vanish without pre-emptive conservation action. Habitat destruction, pesticide exposure, human-induced mortality, persecution, and climate change push common species toward unsustainable declines, jeopardizing their critical roles in ecosystem functioning. Protecting common bat species is essential to maintaining ecosystem functionality, as their abundance underpins the effective delivery of key ecosystem services.

In human-altered landscapes, where rare species are often absent, supporting common species can help maintain such services. However, management actions should be carefully evaluated to avoid unintended competition in more biodiverse areas. Greater attention to common bat species may also benefit rare ones: Studying their resilience can reveal traits that inform conservation strategies for more vulnerable taxa. Moreover, addressing shared threats such as wind turbines and pesticide spread benefits both groups. Finally, common bat species play a key role in public engagement. They are more frequently encountered and thus foster greater support for the conservation of all bat species, common or rare, by raising awareness, stimulating policy action, and enabling fundraising. As the most visible wildlife in urban and suburban environments, common species often represent people's first contact with nature and hold cultural, educational, and emotional value. Their loss may reduce everyday experiences of biodiversity, weakening public support for conservation.

Bats illustrate how even ecologically dominant species can be vulnerable and why conservation frameworks must expand to include widespread species that underpin critical ecosystem functions. Our approach offers a transferable perspective for rethinking the role of common species in biodiversity policy and management.

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Data Availability Statement

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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