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Journal of Lost Species

Why do we need a journal about lost species?

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Abstract: Lost species, those that have not been documented in the wild for extended periods but not declared extinct, are a critical blind spot in biodiversity conservation. Thousands of lost species have been identified, and they occur across most taxonomic groups and ecosystems, yet they remain poorly integrated into extinction risk assessments and conservation planning. Information on lost species is scattered across the scientific literature, institutional databases, and conservation NGO records, and there is currently no dedicated forum for developing shared definitions or rediscovery verification standards, nor for keeping track of data on when species become lost or rediscovered. Here, we set out the rationale for establishing the *Journal of Lost Species* as a centralized platform for lost species research and discourse. We summarize the scale and consequences of the lost species problem and identify priority tasks. These include refining working definitions, developing a comprehensive cross-taxa database integrated with the International Union for Conservation of Nature (IUCN) Red List, improving consistency in tracking last-seen dates and Data Deficient taxa, and supporting more strategic rediscovery efforts. By articulating these needs, we aim to provide a foundation for a community of practice around lost species and to clarify how a dedicated journal can help translate growing interest in lost species into coordinated research and conservation action.

Keywords: bioinformatics, conservation policy, data deficiency, extinction risk, IUCN Red List, lost species, species rediscovery

INTRODUCTION

Lost species, broadly defined as taxa that have not been documented in the wild for extended periods but that have not met formal criteria for extinction, have recently attracted increasing academic interest from researchers, ecologists, and conservationists (e.g., Gippoliti et al. 2024; Lindken et al. 2024; Martin et al. 2023a; Rutt et al. 2024), with very good reason. Biodiversity is declining at an alarming rate (Cowie et al. 2022), with many species slipping into obscurity before their conservation status can be formally assessed (Lees and Pimm 2015). Up to one million species are estimated to be at some risk of extinction in the coming decades (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES] 2019), and recent extinction rates far exceed

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background levels (Turvey and Crees 2019). Together, these trends underscore the scale of biodiversity loss and the urgency of clarifying the status of species that have not been observed for extended periods. Species losses are not only a symptom of global environmental change but also the cause of further ecological instability, for instance exacerbating climate change and the spread of infectious diseases (Gittleman 2024). Within the context of the global biodiversity crisis, species that have not been observed in decades (Fig. 1), and are thus of potential concern, highlight the need for improved approaches to tracking and addressing gaps in conservation knowledge.

Lost species are found in nearly all taxonomic groups and ecosystems (Martin et al. 2023a) and are numerous, with >4000 species identified to date (Re:wild 2026): Fig. 2a highlights the breadth of the phenomenon across vertebrates, plants, invertebrates, and other groups.

Even this high number is likely to be a severe underestimate. Several major vertebrate groups, including tetrapods (amphibians, birds, mammals, and reptiles), Chondrichthyes (sharks, rays, skates, and chimaeras), and freshwater fishes, have now been systematically evaluated; however, lost species have not yet been identified for many under-studied higher taxa (e.g., for fungal groups). Lost species are likely to be especially prevalent in poorly studied groups because basic documentation is incomplete, and many species may qualify as lost simply because no one has systematically reviewed or updated occurrence records. There may also be many species that, while known, have not yet been formally described, and many of these may also be lost (Darrah et al. 2020). In that context, the existence of lost species in well-studied taxa highlights the breadth of the problem. Given that we have neither a centralized platform of discourse for tracking lost species nor an organized way to approach

Figure 1. Museum holotypes and paratypes illustrating the taxonomic and geographic breadth of lost species globally. (A) Zug's monitor, *Varanus zugorum*, last seen in 1980. (B) Small-flower beardtongue, *Penstemon parviflorus*, last seen in 1890. (C) Arhurt's stubfoot toad, *Atelopus arthuri*, last seen in 1988. (D) Pink-headed duck, *Rhodonessa caryophyllacea*, last seen in 1923. (E) Bullneck seahorse, *Hippocampus minotaur,* last seen in 1996. (F) Dwarf hutia, *Mesocapromys nanus*, last seen in 1937. (A–D) Courtesy of the Smithsonian Institution; (E) Courtesy of Graham Short, Australian Museum; (F) Courtesy of Samuel Turvey, from Instituto de Ecología y Sistemática (IES), Havana, Cuba. Images reproduced with permission or under institutional open-access policies.

consensus on the various (and often complex) concepts and "rules" surrounding lost species, organizing the community to effectively deal with the phenomenon is a complex and pressing conservation goal.

Although the documentation of lost species and the exploration of related methodological issues are core goals of the *Journal of Lost Species*, the journal also provides a place for researchers to report on putative extinctions as well as species that are declining or imperiled but not necessarily lost. In this article, we focus on implementation and development of the lost species concept. The launch of the *Journal of Lost Species* represents a crucial opportunity to centralize both the data and the conceptual discourse within the emerging field of lost species research. Below, we outline why the

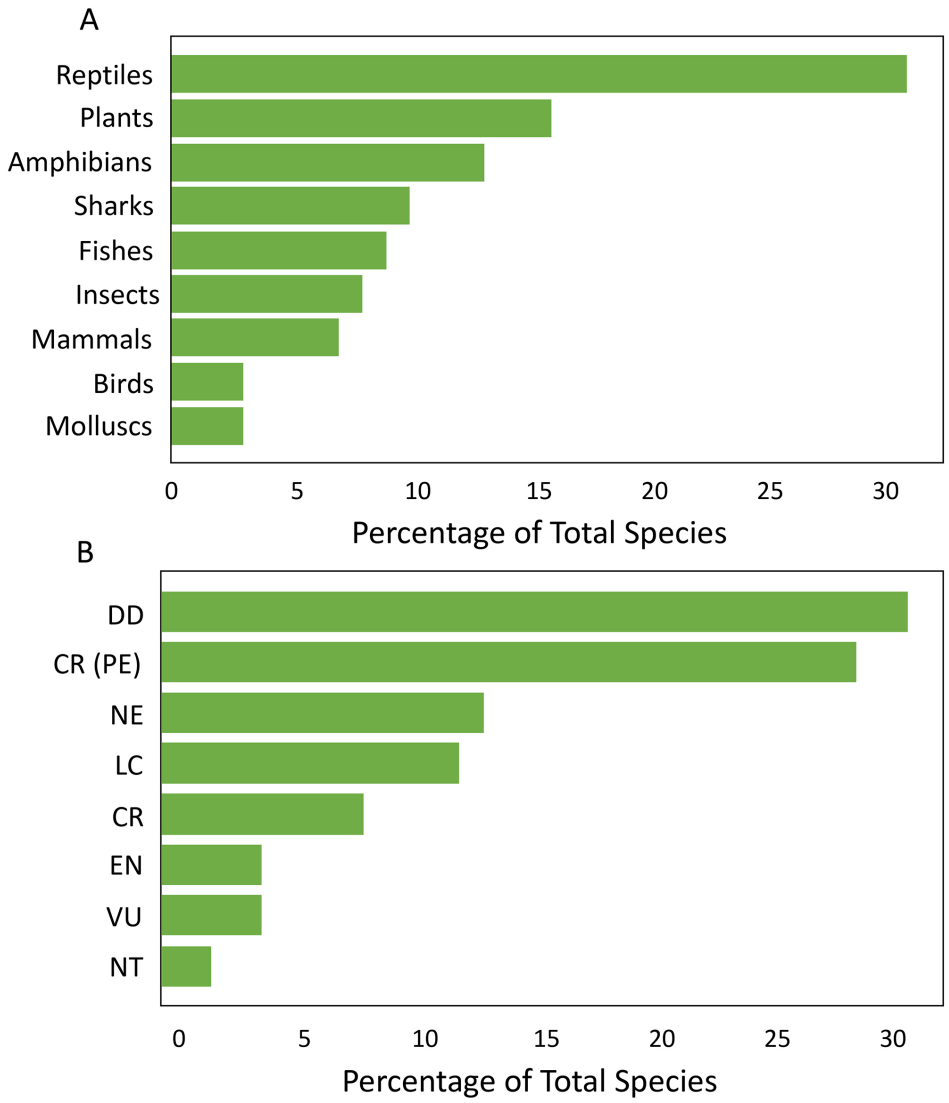

Figure 2. Bar graphs showing (A) taxonomic distribution of lost species identified globally, and (B) IUCN Red List classifications of species identified as lost globally. N for both graphs = 4,337. IUCN Red List categories are defined as: DD = Data Deficient, CR(PE) = Critically Endangered Possibly Extinct, NE = Not Evaluated, LC = Least Concern, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, and NT = Near Threatened. Numbers of lost species and their relative proportions within each Red List category are derived from the Re:wild global lost species list (Re:wild, 2026; accessed 28 February 2026), cross-referenced with the IUCN Red List (2026).

establishment of a journal focusing specifically on lost species is important and highlight what we believe are foundational questions to answer, and issues to clarify, in order to create a solid framework on which future lost species research can be based.

The lost species problem

Lost species span the full spectrum of biodiversity found across all ecosystems, from terrestrial to freshwater to subterranean to marine (Martin et al. 2023a; Re:wild 2025). Addressing lost species on only taxonomic or ecosystem levels (e.g., in taxonomic-focused forums) may capture isolated problems but will likely fail to address the scale of holistic issues, potentially leading to conservation gaps and reinforcing existing biases in research and conservation efforts (Caldwell et al. 2024). By centralizing cross-taxa data, analyses, and debate in a single forum, the *Journal of Lost Species* can make spatial, taxonomic, and methodological biases more visible and thereby facilitate more coordinated and equitable conservation responses.

Lost species represent an important knowledge gap regarding which species are extant versus extinct (coined the 'Latimerian Shortfall' by Martin et al. 2023a). For any species, being lost has significant implications for its conservation status (Fig. 3). First, it creates uncertainty about whether the species requires urgent conservation intervention. Second, the very fact that a species is lost indicates that essential information needed to guide conservation action is missing. More broadly, conservation efforts for at-risk lost species will be fragmented and incomplete (Abeli et al. 2022; Cazalis et al. 2023). Reliable, up-to-date information is needed for species-oriented conservation, and "up to date" means, at minimum, "not lost."

While we need to identify which lost species are most in need of conservation attention,

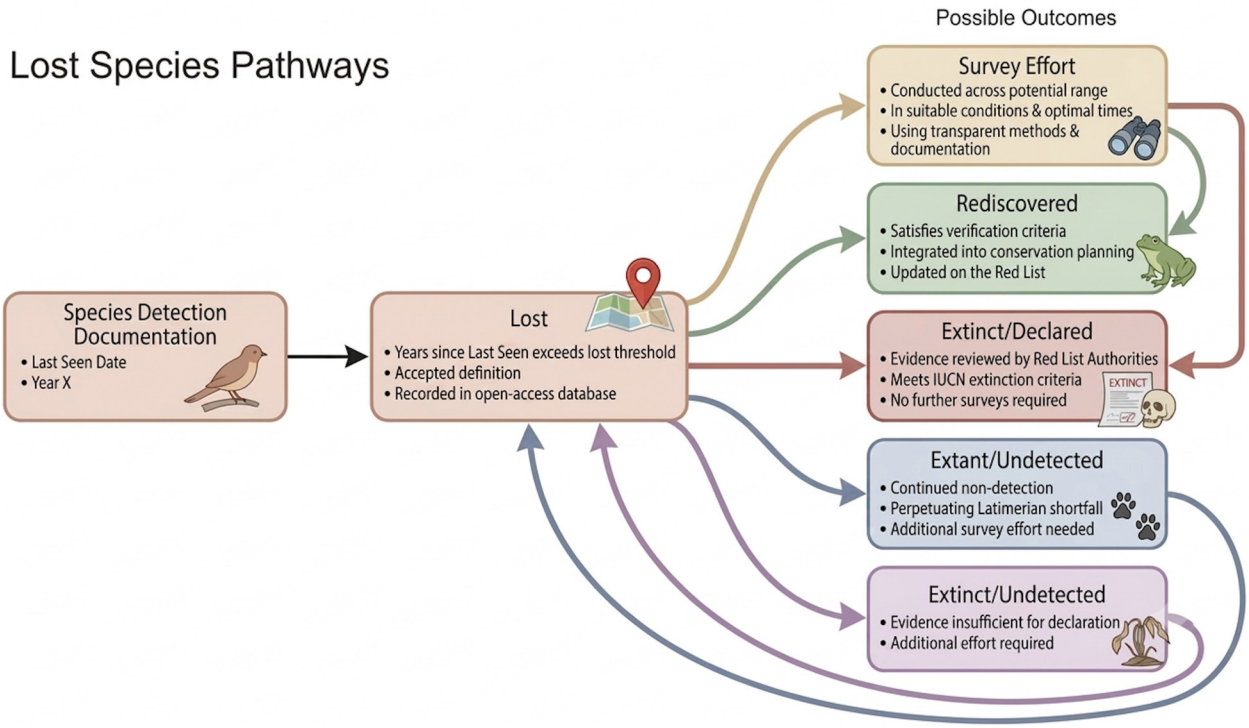

Figure 3. Conceptual diagram illustrating the framework for lost species trajectories and governance. The diagram shows the progression of a lost species from its last documented occurrence through its "lost" status, on to one of five subsequent potential outcomes. The framework clarifies the decision points and documentation requirements that shape how species transition between states.

their current conservation status is typically hard to determine. For instance, the majority of lost terrestrial vertebrates are considered either threatened or Data Deficient by the International Union for Conservation of Nature (IUCN) (Martin et al. 2023a, Fig. 2b). Some of these threatened species are suspected of being extinct, but determining which species are extinct is not possible without targeted fieldwork efforts (Martin et al. 2023a) and formal evaluation and declaration of extinction by the IUCN. At a broader scale, fully 30 percent of the species on the Texas-based environmental non-governmental organization Re:wild's (www.rewild.org) list of lost species are classified as Data Deficient by the IUCN, a designation with a more than random chance of indicating some elevated level of threat (Borgelt et al. 2022).

Importantly, Data Deficient species among lost species occur even within relatively well-studied taxonomic groups, including amphibians, birds, fishes, mammals, and sharks, underscoring that documentation gaps are not confined to poorly studied taxa. The full Re:wild list spans a broad range of taxa, including fungi, plants, and many invertebrate groups such as mollusks and insects, most of which have not been comprehensively assessed by the IUCN. The presence of Data Deficient lost species across multiple well studied taxa, coupled with the absence of Data Deficient designations in many poorly studied groups, reflects underlying documentation and assessment biases rather than a true absence of extinction risk. Gaps in Red List assessments further compound this issue: many accounts are outdated, making comprehensive conservation decision-making difficult (Abeli et al. 2022; Cazalis et al. 2023). Birds are a well-documented group and show a relatively low proportion of lost species (1.2%) (Rutt et al. 2024), while the corresponding proportion for the Laboulbeniomycetes fungi is over 70 percent (Haelewaters et al. 2024). Many vascular plant species lack digitized, georeferenced occurrence records at usable spatial resolution, reflecting a persistent Wallacean shortfall. Without such spatially explicit documentation, they cannot be reliably assessed against the temporal criteria used to define lost species and therefore cannot currently be classified as lost (Ondo et al. 2023). This is particularly significant given that poorly studied taxonomic groups may bear the brunt of Anthropocene extinction events (Moura and Jetz 2021; Wiens and Zelinka 2024). The conclusion from these observations is that many lost species are of high, and perhaps very high, conservation concern.

Species become lost due to a complex interplay of biodiversity loss, data deficiencies, and underrepresentation in conservation and biological survey efforts. While some lost species do (or did) occur in temperate and even urbanized regions where habitat degradation and historical collection biases can leave species overlooked (Martin et al. 2023b), most occur in tropical biodiversity hotspots where high species richness and low survey effort contribute to knowledge gaps (Gippoliti et al. 2024). To the extent that lost species are at high risk of being imperiled, neglect of these regions creates an uneven playing field in conservation, where charismatic or readily studied species in the global north receive much more attention than those that may be at even greater risk.

Alongside their own particular problems, lost species also contribute to a larger issue: the existence of so many lost species may lead to a misunderstanding of the seriousness of the Anthropocene extinction crisis. Even within groups with sufficient IUCN Red List coverage, many lost species have remained lost for decades or even centuries, even when the possibility that they are still extant has become very remote (Martin et al. 2023a). The result of this is that the total number of recent recorded extinctions is biased to be low (Cowie et al. 2022). The extent of this bias is simply unknown. So, without species-specific research (starting with a confirmation that lost species are indeed still extant), it is hard both to implement conservation action for the species in question or to develop a precise view of Anthropocene impacts on global biodiversity.

Key questions and tasks for lost species researchers

One core task of the *Journal of Lost Species* is to help keep track of which species are lost, to help prioritize which require conservation action, and ultimately to decrease the Latimerian shortfall. In addition, the journal should act as a platform for discussing concepts and ideas relating to managing lost species. We identify the following potential priorities that, if tackled, should allow for the establishment of a strong framework on which to base future lost species research.

Refining the definition of lost species

A clear, widely accepted definition of lost species is essential to help track and prioritize conservation efforts. The existing definition proposed by Long and Rodríguez (2022) is "not confirmed alive by photographic, audio or genetic information for over 10 years in the wild and [having] no *ex-situ* population under human care," with those species not documented for ten or more years generally considered 'lost' and those not documented for >5 years deemed 'missing'. While the distinction between >10 years and ≥10 years remains an ambiguity in the current definition, the ten-year threshold provides a clear and operational starting point intended to be broadly applicable across taxa and ecosystems. However, these definitions may need expanding to incorporate rediscovery validation criteria, consistent use of last-seen dates (including what types of records qualify as documentation), and the weight of different types of evidence (Martin et al. 2023b). It may also be that five years, or even ten years, is too short an interval without observation to distinguish between potential disappearance versus limited survey effort for most taxa, especially with respect to poorly studied taxa. Additionally, it may not be practical to keep track of observation data for such short time periods for thousands of species. Whether the definition of 'lost' should be taxa-specific and varying based on individual group characteristics is an important first question. This is a matter that requires both input from a diverse group of stakeholders and further case studies. Certainly, establishing an agreed-upon definition is vital to ensure consistency across conservation efforts and to facilitate better tracking of lost species within the IUCN Red List framework.

Developing a centralized, authoritative lost species database

An authoritative database for keeping track of lost species does not exist. Re:wild has included several iterations of lost species lists on their website since 2017, with the most recent (2024) encompassing 4,337 species across multiple taxa and ecosystems (Re:wild 2026). Biggs et al. (2022) called for a "single, comprehensive list that includes all taxa, all stages of the pathway of loss, data on the reason(s) for loss, and proposed actions [that] needs to be updated and published annually with a Digital Object Identifier (DOI) to provide a synthetic source of information." Finding a means to keep such a database continually updated represents a major undertaking, but nevertheless also represents an important priority.

A centralized, authoritative database would provide more than simple aggregation. It would ensure that agreed definitions, temporal thresholds, and rediscovery validation criteria are applied consistently across taxa, reducing fragmentation, duplication, and potential confusion. While multiple interoperable databases linked via Application Programming Interfaces (APIs) could in principle achieve similar outcomes, the absence of a clearly recognized reference source risks perpetuating siloed or inconsistently curated lists. A single, enduring platform with shared governance could improve transparency, accountability, and ease of use, functioning as a definitive reference point for researchers, IUCN Specialist Groups, national level orga-

nizations, policymakers, and funders. Fundamentally, effective rediscovery and conservation planning depend on first knowing which species are considered lost; without a reliable and accessible list, strategic search efforts cannot even begin.

In addition to establishing a centralized lost species database, integrating such a list into global conservation databases by strengthening collaboration and data sharing across institutions is also essential. This includes developing interoperable data-sharing agreements with external partners such as the IUCN, the Global Biodiversity Information Facility (GBIF), iNaturalist, museums, universities, and conservation non-governmental organizations (NGOs), as well as creating an open-access lost species dashboard to ensure up-to-date information can be contributed and made readily available to researchers, practitioners, and IUCN Specialist Groups.

Implementing standardized validation criteria for lost species rediscovery

A pressing need with respect to managing lost species is a clear and transparent process for validating rediscovery claims. Long and Rodríguez (2022) provide a working evidentiary standard, requiring photographic, audio, or genetic confirmation of a species' presence after at least ten years without detection. However, the practical application of these criteria raises additional questions concerning verification, adjudication, and evidentiary sufficiency. In practice, questions remain about how different forms of evidence are evaluated. For example, how should expert sightings without physical evidence be treated? Do positive environmental DNA (eDNA) results constitute sufficient proof of rediscovery? How should citizen science records be assessed for reliability? Should validation requirements vary by taxonomic group or habitat, or should this always be standardized? An additional question is whether rediscoveries require multiple independent lines of evidence, or whether a single, well-documented record would suffice. While multiple lines of evidence may increase confidence in some contexts, rigid requirements could unintentionally discourage reporting or delay conservation response, especially in systems where survey effort and funding are already limited. Highly distinctive species may also be readily identified by a single objective record, such as a clear photograph (e.g., Hunowo et al. 2019), rendering other lines of evidence redundant. A more pragmatic approach may involve flexible, taxon- and context-specific standards that balance evidentiary rigor with feasibility and urgency. And, critically, who determines whether evidence meets established standards to confirm rediscovery, and through what review process and by whom? Resolving these questions is of high importance; without a consistent framework, the classification of rediscovered species remains subjective, leading to inconsistencies in conservation planning and decision-making as well as serious problems with communication to the wider public (Martin et al. 2023b).

Improving integration of lost species within existing IUCN Red List frameworks

The IUCN Red List remains the global standard for assessing species extinction risk, and the lost species concept could strengthen existing Red List assessments by improving the consistency and accessibility of information on when species were last documented, rather than replacing or modifying existing Red List categories and criteria. While Red List assessments evaluate extinction risk, the designation of a species as 'lost' addresses a different but related question: whether a species lacks recent, documented evidence of continued existence. The IUCN Red List already incorporates this type of information through the use of last-seen or last-documented records in many assessment narratives and, in particular when evaluating species as Critically Endangered (Possibly Extinct) (CR(PE)). However,

these data are not currently recorded in a standardized, searchable format across all assessments.

Although last-seen dates and Possibly Extinct (PE) markers are already incorporated into some assessments, their inconsistent application limits their utility for monitoring and conservation prioritization (Martin et al. 2023a). Alongside inputs such as Red List status, providing all assessed species with a last seen or last documented date (or flagging species as meeting particular thresholds) would provide additional information to support conservation decision-making. Ensuring that Red List accounts consistently reflect information relevant to lost species would require collaboration across IUCN Specialist Groups, conservation organizations, and researchers to ensure the use of common criteria and terminology. The goal is one of focus and consistency, rather than creating new data streams or substantially increasing assessment effort. Integrating lost species information into formal assessments (by the IUCN or other bodies) would strengthen the value of these products by providing an additional input for conservation decision-making. Formal conservation prioritization requires weighing multiple factors, and whether a species is considered lost represents one such consideration.

Given the fact that IUCN assessors often have the greatest expertise on any given species, having them flag species as potentially 'lost' at the assessment stage may be the most efficient way to identify newly lost species or highlight cases where additional information is needed. This approach could be integrated with the centralized database described above, ensuring that lost species receive appropriate conservation attention and that rediscoveries, continued absence despite targeted search effort, and other relevant information are systematically recorded and available to inform future assessments (Biggs et al. 2023).

In this context, a further consideration is whether the *Journal of Lost Species* might eventually support periodic Lost Species Status Reports that summarize rediscoveries, document newly identified lost species and identify emerging taxonomic or geographic patterns. If capacity and resources allow, such syntheses could provide an efficient way to track trends across taxa and regions and offer conservation practitioners a consolidated view of the most recent developments, as well as highlighting areas where renewed survey effort may be needed. Alternatively, if a centralized, current, and maintained database is established, many users may be able to query it directly, which would complement formal reports.

Identifying priority areas for targeted fieldwork to search for lost taxa

Rediscovery is the overarching goal of most lost species research. Each rediscovery (or a lack of rediscovery that leads to a proposed extinction declaration) reduces the Latimerian shortfall, improving our knowledge of which species are globally extant, and which are truly gone. For the species in question, rediscovery can act as a powerful catalyst for conservation, spurring funding, mobilizing local and international conservation efforts, and driving habitat protection initiatives (Scheffers et al. 2011). Currently, accumulation of new lost species designations outpaces the rate of rediscovery, particularly for amphibians and mammals, suggesting that more proactive search strategies are needed (Lindken et al. 2024). Some species remain lost due to their small body size, cryptic behavior, or the difficulty of surveying their environments, while others may already be extinct but lack the necessary evidence for confirmation (Gardner et al. 2024).

Rediscovery of lost taxa invariably requires fieldwork efforts, and funders appear to be increasingly unwilling to support fieldwork (Ríos-Saldaña et al. 2018). The most efficient means of rediscovering the greatest number of lost species with the fewest resources may be to develop global informatics tools that identi-

fy particularly high geographic concentrations of lost species in areas that are also logistically or geopolitically accessible to field scientists. Similarly, developing approaches to determine which individual species may be particularly likely to yield a rediscovery (or otherwise proof of extinction) based on their traits and ecology may also improve rediscovery success (Lindken et al. 2024). Predictive modeling approaches (*sensu* Moura and Jetz 2021) may further strengthen these efforts by integrating species traits, environmental covariates, historical collection data, drivers of loss, and survey effort to estimate rediscovery probability and spatial search priorities. Such models could help allocate limited field resources more strategically by identifying species-region combinations with the highest likelihood of success.

To maximize rediscovery success, a coordinated Lost Species Rediscovery Protocol may be needed. This would standardize procedures for field surveys, verification of evidence (see discussion of this issue above), and documentation of rediscoveries across taxa and regions, enabling IUCN Specialist Groups, researchers, and conservation partners to align methodologies and improve efficiency in rediscovery efforts.

Building capacity for lost species management

Rediscovery is only one step; ensuring that rediscovered species are rapidly integrated into conservation action requires consistent guidance, shared standards, and accessible information. A dedicated journal can help catalyze this process by publishing best-practice models for linking rediscoveries to updated Red List assessments, conservation action plans, and funding pathways. By providing a venue for documenting policy frameworks, decision trees, and examples of successful post-rediscovery responses, the *Journal of Lost Species* will support the development of mechanisms that allow conservation action to follow directly from new evidence and so help prevent newly rediscovered species from slipping back into obscurity.

Strengthening long-term capacity for managing lost species also depends on sustained training, practitioner support, and knowledge exchange. This includes supporting locally-led conservation efforts and ensuring that researchers and practitioners in regions where lost species occur have access to resources, opportunities to share existing knowledge, and the ability to guide rediscovery and recovery efforts. Here the journal can play a critical role by publishing training modules, methodological guidelines, workshop outputs, and policy recommendations that equip conservation practitioners, governments, and researchers with the tools needed to identify, assess, and manage lost species. As a centralized platform, it can amplify lessons learned, standardize practice across taxa and regions, and facilitate continuity in a field that currently lacks shared infrastructure. In doing so, the *Journal of Lost Species* would become not only a repository of rediscoveries, but also a hub for building and maintaining the expertise required to translate those rediscoveries into durable conservation impact.

Future considerations

The high-level challenges outlined above encompass a wide array of more detailed and technical questions. Refining the boundaries of what constitutes a lost species across taxa and realms will require confronting taxon-specific detectability constraints, synonymies, cryptic diversity, and the potential need for gradient or effort-adjusted definitions rather than rigid temporal cutoffs. Evidentiary standards will likely need similar refinement. As modern technologies such as eDNA or artificial intelligence (AI)-based identifications involving, for example, autonomous bioacoustics, and community-sourced observations become more widely used, conservation practitioners will need clearer guidance on what constitutes adequate proof of presence, how confidence levels

are expressed, and how to adjudicate contested or partial evidence. These questions are intertwined with others concerning documenting and comparing search effort, incorporating imperfect detection, identifying when a species transitions from 'lost' to 'possibly extinct,' and determining which species or regions should be prioritized for renewed surveys. This partial list illustrates how both methodological and conceptual work will be necessary to support consistency and rigor in future rediscovery claims and assessments.

Downstream of definitions and evidence, a further set of challenges exists around governance, equity, data architecture, and long-term accountability. Integrating lost species information across platforms like the Red List, GBIF, museum collections, national datasets, and community knowledge systems will require advances in data interoperability, versioning, traceability, and geoprivacy protections. Many rediscovery efforts hinge on partnerships with local and Indigenous communities, raising essential questions of Free, Prior, and Informed Consent (FPIC); benefit-sharing; data sovereignty; authorship; and decision-making power. As rediscoveries increasingly intersect with policy (e.g., designation of Key Biodiversity Areas, recognition of Other Effective Area-based Conservation Measures [OECMs], and emergency protections), the field must consider when and how rediscovery should trigger rapid conservation action. Additional complexities arise around permitting, biosecurity, funding incentives, and stewardship responsibilities for any collected material. Finally, the entire lost-species enterprise will need transparent metrics for evaluating progress, tracking not just rediscoveries and extinctions, but knowledge gains, threat reduction, habitat security, and learning from failures or contested identifications. Together, these emerging considerations reflect the breadth of issues that researchers, practitioners, policymakers, and communities must navigate as lost species conservation becomes more systematic and globally coordinated.

CONCLUSION

Lost species represent a critical gap in global conservation efforts, obscuring our understanding of extinction rates and biodiversity patterns, complicating conservation prioritization, and disproportionately affecting poorly studied taxa and regions. The *Journal of Lost Species* can address these challenges by providing a centralized platform for lost species research and discourse. By publishing work that refines definitions, that develops and tests rediscovery validation criteria, and that advances a comprehensive and interoperable lost species database, the journal can help establish the standardized frameworks that are currently missing. It can also serve as the central venue for case studies; for synthesizing disparate data sources; and for producing the comparative analyses needed to clarify patterns, trends, and drivers of lost species across taxa and regions. The *Journal of Lost Species* can not only connect and enhance existing efforts across institutions, but also foster the infrastructure needed to ensure that (i) lost species are systematically tracked and searched for; (ii) rediscoveries are verified and acted upon; and (iii) both rediscovered and extinct species are meaningfully incorporated into global conservation planning and policy.

Author contributions

C.B. and T.M. contributed to the conceptual development of the manuscript and wrote the first draft of the manuscript. All authors contributed to manuscript development, interpretation, and revisions. All authors reviewed and approved the final version of the manuscript.

Ethical standards and competing interests

This work did not involve fieldwork, animal handling, or experimental procedures. All information used in this study was obtained from previously published sources and publicly available data. C.B. serves on the Advisory Board for the *Journal of Lost Species*. A.M. and T.M. serve as Handling Editors for the *Journal of Lost Species*. The authors declare no other competing interests.

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