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Opinion

Dire wolves and extinct curlews: are we failing at saving and communicating real biodiversity?

ABSTRACT

In an era of mass extinction, conservation requires an urgent triage - prioritizing species most at risk while redirecting resources from charismatic megafauna to overlooked taxa. Natural history museums are ideal places where this task could be explained to the general public and pursued. As a solution, they might adopt an "emergency room" approach, classifying species by threat level (e.g., "red code" for highly threatened taxa) to guide ethical conservation decisions. As taxonomists disappear and collections languish, this scientific triage becomes impossible without revitalized museum roles in research, education, and advocacy. The future of biodiversity hinges on recognizing that not all species can be saved, but strategic choices can prevent irreversible losses.

Keywords: conservation triage, extinction crisis, natural history museums, threat assessment, biodiversity prioritization, conservation ethic.

Biologists, particularly taxonomists, have repeatedly recognised a paradoxical truth: despite unprecedented environmental degradation and extinctions, our planet remains hyper-diverse. While around 2 million species have been formally described, it is estimated that there are actually between 8 and 12 million species on Earth (Mora *et al.*, 2011; Costello *et al.*, 2013; Li & Wiens, 2023; Wiens, 2023). Clearly, the majority of Earth's biodiversity remains undocumented - a vast frontier of life waiting to be discovered.

Natural history museums once played a key role in advancing our understanding of biodiversity, housing extensive scientific collections that formed the basis of taxonomy, ecology, and conservation biology. However, many of these institutions are now struggling to fulfil their scientific remit due to budget cuts, shifting priorities, and a decline in taxonomic expertise (Andreone *et al.*, 2022). Nevertheless, their potential role in combatting biodiversity loss has never been more crucial.

However, the scientists responsible for this monumental task - the so-called taxonomists - are a disappearing breed themselves and can be considered a threatened working category (Drew, 2011). Natural history museums, once the epicentres of taxonomic research, are undergoing profound changes, often prioritising spectacle over

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science and public engagement over the valorisation and preservation of collections (Alberch *et al.*, 1994). In many cases, especially in certain countries (Andreone *et al.*, 2014), funding shortages and political short-sightedness are limiting fieldwork and taxonomic collections (Guénard *et al.,* 2025).

As museum collections are increasingly stored away and often made difficult to be valorised (Andreone *et al.*, 2014), the expertise needed to interpret them is gradually being lost. Reviving taxonomy requires investment in training new generations of specialists, as well as digitising collections to make them globally accessible (Rocha *et al.*, 2014). If we lost taxonomic and natural history competences, our communication will overlap with that of other media. This is already visible with the social communication of some zoological gardens, with an overly easy focus on charismatic and fancy species that is due to a poor scientific background of professional communicators (S. Gippoliti, pers. obs.).

Nevertheless, field surveys remain vital for discovering and conserving biodiversity. They are essential for documenting and conserving biodiversity. Almost every expedition into poorly studied tropical regions yields hundreds of new species (Rakotoarison *et al.*, 2017), and even well-explored temperate zones continue to reveal surprises (Gippoliti & Amori, 2002). However, funding for this essential work is decreasing as it is being diverted towards more attention-grabbing projects, such as the recent hype surrounding the "resurrection" of the extinct dire wolf, *Aenocyon dirus*. While this narrative has been debunked by scientists, it has been amplified by sensationalist reporting (Jacobs, 2025; Le Page, 2025). This misdirection of attention and resources exacerbates a dangerous disconnect: while thousands of lesser-known species slide towards extinction unnoticed, the public and politicians remain fixated on a handful of charismatic megafauna - or worse still, extinct species repackaged as de-extinction fantasies.

We should therefore consider the idea that biological conservation is essentially a form of triage: some species require urgent intervention, some can wait, and some (such as invasive or domesticated animals) should have no place in wild ecosystems. Natural history museums have increasingly associated to their traditional finalities of discovering, describing and studying species and ecosystems also their conservation (Butler *et al.*, 1998), could (and should) transform public understanding by creating exhibits and awareness initiatives modelled on emergency rooms, where species are "diagnosed" based on their conservation status. "Domestic cats *Felis catus*: Non-native predator - white code"; "Iberian lynx *Lynx pardinus*: Endangered - red code".

The recent near-official extinction of the slender-billed curlew *Numenius tenuirostris* (AEWA, 2025; Buchanan *et al.*, 2024) passed with little public notice. Why? Because most people had never heard of it. Museums should counteract this "species amnesia" by spotlighting lesser-known taxa, not just as static displays, but as dynamic stories of evolution, ecological roles, and extinction risks. Such displays would form and encourage visitors to recognise that conservation is not just about saving the most photogenic species, but about making scientifically-informed and ethically-sound choices. We therefore believe that museums (together with zoological parks, aquaria, herbaria, botanical gardens) should become the forefront for biodiversity conservation. Not necessarily working directly to conserve vanishing species (even if in some cases this could happen and should be welcome), but especially by talking to a quite disinformed public, too often shaken by TV programs and by social media. As said, it is important to highlight – with scientific rigour – which are the species which are most at risk, and indicating conservation strategies. This was the target of the extinction project which led to the

realisation of an exhibit at the Turin Museum dedicated to extinctions (Andreone *et al.,* 2019).

As highlighted by Andreone *et al.* (2014, 2022) and Gippoliti (pers. obs.), the decline of taxonomy and the marginalization of museum collections pose a direct threat to biodiversity conservation. In an era of accelerated extinctions, the loss of specialized expertise and the lack of political support for field investigations risk condemning countless unknown and undescribed species to vanish unnoticed. Yet, museums - if properly funded and prioritized-could still play a pivotal role in bridging the gap between science and society, fostering a deeper public understanding of biodiversity and its urgent conservation challenges. As argued by Gippoliti & Amori (2002), renewed investment in training taxonomists and valorizing historical collections is essential, transforming museums from mere repositories of the past into active hubs of research and education. Only through such efforts can we effectively address the biodiversity crisis, ensuring that no branch of the tree of life disappears into oblivion before it is even known. The time to act is now: museums must either lead this charge or risk becoming complicit in the silent extinction of both species and the knowledge needed to save them.

The future of biodiversity depends also on whether museums can reclaim their role as bridges between science and society. This means: (a) rejecting sensationalism in favor of evidence-based narratives; (b) championing understudied species before they vanish unnoticed; (c) lobbying governments to prioritize taxonomic research and habitat protection. If museums fail to act, we risk losing not just species, but the very knowledge needed to save them. The choice is stark: Will museums become relics of a lost natural world, or evolve into the vanguard of its salvation?

RIASSUNTO

Lupi terribili e chiurlottelli estinti: stiamo fallendo nel salvare (e comunicare) la vera biodiversità?

In un'era di estinzioni di massa, la conservazione richiede un triage urgente - prioritizzare le specie più a rischio reindirizzando le risorse dalla megafauna carismatica ai taxa più trascurati. I musei di storia naturale dovrebbero adottare un approccio da 'pronto soccorso', classificando le specie secondo il loro livello di minaccia (ad esempio “codice rosso” per quelle criticamente minacciate) per guidare scelte conservative eticamente fondate. Con la scomparsa dei tassonomisti e il progressivo declino delle collezioni, questo triage scientifico diventa impossibile senza un rinnovato ruolo attivo dei musei nella ricerca, nell'educazione e nella “advocacy”. Il futuro della biodiversità dipende dalla capacità di riconoscere che non tutte le specie potranno essere salvate, ma che scelte strategiche possono prevenire perdite irreversibili.

Parole chiave: triage conservativo, crisi di estinzione, musei di storia naturale, valutazione delle minacce, prioritarizzazione della biodiversità

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REFERENCES

AEWA [Agreement on the Conservation of African-Eurasian Migratory Waterbirds], 2025. Marking the loss of the slender-billed curlew: A wake-up call for conservation. - https://www.unep-aewa.org/en/news/marking-loss-slender-billed-curlew-wake-call-conservation

ALBERCH P., ZAVALA L., MILES R., 1994. The identity crisis of natural history museums at the end of the twentieth century. - In: Miles R., Zavala L. (Eds), Towards the museum of the future. New European perspectives. - Routledge, London: 195-200.

ANDREONE F., BARTOLOZZI L., BOANO G., BOERO F., BOLOGNA M., BON M., BRESSI N., CAPULA M., CASALE A., CASIRAGHI M., CHIOZZI G., DELFINO M., DORIA G., DURANTE A., FERRARI M., GIPPOLITI S., LANZINGER M., LATELLA L., MAIO N., MARANGONI C., MAZZOTTI S., MINELLI A., MUSCIO G., NICOLOSI P., PIEVANI T., RAZZETTI E., SABELLA G., VALLE M., VOMERO V., ZILLI A., 2014. Italian natural history museums on the verge of collapse? – ZooKeys, 456: 139-146.

ANDREONE F., BOERO F., BOLOGNA M.A., CARPANETO G.M., CASTIGLIA R., GIPPOLITI S., MASSA B., MINELLI A., 2022. Reconnecting research and natural history museums in Italy and the need of a national collection biorepository. - ZooKeys, 1104: 55-68.

ANDREONE F., GAVETTI E., GIACOBINO E., 2019. Le estinzioni della biodiversità. Idee per la conservazione della natura. Museo Regionale di Scienze Naturali, Torino.

BUCHANAN G.M., CHAPPLE B., BERRYMAN A.J., CROCKFORD N., JANSEN J.F.J., BOND A.L., 2024. Global extinction of slender-billed curlew (*Numenius tenuirostris*). - Ibis, 167: 357-370.

BUTLER D., GEE H., MACILWAIN C., 1998. Museum research comes off list of endangered species. - Nature, 394 (6689): 115-117.

COSTELLO M.J., MAY R.M., STORK N.E., 2013. Can we name Earth's species before they go extinct? - Science, 339 (6118): 413-416.

DREW L.W., 2011. Are we losing the science of taxonomy? As need grows, numbers and training are failing to keep up. - BioScience, 61 (12): 942-946.

GIPPOLITI S., AMORI G., 2002. Mammal diversity and taxonomy in Italy: implications for conservation. - Journal for Nature Conservation, 10: 33-44.

GUÉNARD B., HUGHES A.C., LAINÉ C., CANNICCI S., RUSSELL B.D., WILLIAMS G.A., 2025. Limited and biased global conservation funding means most threatened species remain unsupported. – PNAS https://doi.org/10.1073/pnas.2412479122

JACOBS P., 2025. Is the dire wolf back from the dead? Not exactly. - Science doi: 10.1126/science.zl0oigi

LE PAGE M., 2025. No, the dire wolf isn't back. - New Scientist. 266 (3539): 9.

LI X., WIENS J.J., 2023. Estimating global biodiversity: the role of cryptic insect species. - Systematic Biology, 72 (2): 391-403. https://doi.org/10.1093/sysbio/syac069

MORA C., TITTENSOR D.P., ADL S., SIMPSON A.G.B., WORM B., 2011. How many species are there on Earth and in the Ocean? - PLoS Biol 9 (8): e1001127. https://doi.org/10.1371/journal.pbio.1001127

RAKOTOARISON A., SCHERZ M.D., GLAW F., KÖHLER J., ANDREONE F., FRANZEN M., GLOS J., HAWLITSCHEK O., JONO T., MORI A., NDRIANTSOA S.H., RAMINOSOA N.R., RIEMANN J.C., RÖDEL M.-O., ROSA G.M., VIEITES D.R., CROTTINI A., VENCES M., 2017. Describing the smaller majority: integrative taxonomy reveals twenty-six new species of tiny microhylid frogs (genus *Stumpffia*) from Madagascar. Vertebrate Zoology, 67(3): 271-398.

ROCHA L.A., ALEIXO A., ALLEN G., ALMEDA F., BALDWIN C.C., BARCLAY M.V.L., BATES J.M., BAUER A.M., BENZONI F., BERNS C.M., BERUMEN M.L., BLACKBURN D.C., BLUM S., BOLAÑOS F., BOWIE R.C.K., BRITZ R., BROWN R.M., CADENA C.D., CARPENTER K., CERÍACO L.M., CHAKRABARTY P., CHAVES G., CHOAT J.H., CLEMENTS K.D., COLLETTE B.B., COLLINS A., COYNE J., CRACRAFT J., DANIEL T., DE CARVALHO M.R., DE QUEIROZ K., DI DARIO F., DREWES R., DUMBACHER J.P., ENGILIS JR. A., ERDMANN M.V., ESCHMEYER W., FELDMAN C.R., FISHER B.L., FJELDSÅ J., FRITSCH P.W., FUCHS J., GETAHUN A., GILL A., GOMON M., GOSLINER T., GRAVES G.R., GRISWOLD C.E., GURALNICK R., HARTEL K., HELGEN K.M., HO H., ISKANDAR D.T., IWAMOTO T., JAAFAR Z., JAMES H.F., JOHNSON D., KAVANAUGH D., KNOWLTON N., LACEY E., LARSON H.K., LAST P., LEIS J.M., LESSIOS H., LIEBHERR J., LOWMAN M., MAHLER D.L., MAMONEKENE V., MATSUURA K., MAYER G.C., MAYS JR. H., MCCOSKER J., MCDIARMID R.W., MCGUIRE J., MILLER M.J., MOOI R., MOOI R.D., MORITZ C., MYERS P., NACHMAN M.W., NUSSBAUM R.A., Ó FOIGHIL D., PARENTI L.R., PARHAM J.F., PAUL E., PAULAY G., PÉREZ-EMÁN J., PÉREZ-MATUS A., POE S., POGONOSKI J., RABOSKY D.L., RANDALL J.E., REIMER J.D., ROBERTSON D.R., RÖDEL M.-O., RODRIGUES M.T., ROOPNARINE P., RÜBER L., RYAN M.J., SHELDON F., SHINOHARA G., SHORT A., SIMISON W.B., SMITH-VANIZ W.F., SPRINGER V.G., STIASSNY M., TELLO J.G., THOMPSON C.W., TRNSKI T., TUCKER P., VALQUI T., VECCHIONE M., VERHEYEN E., WAINWRIGHT P.C., WHEELER T.A., WHITE W.T., WILL K., WILLIAMS J.T., WILLIAMS G., WILSON E.O., WINKER K., WINTERBOTTOM R., WITT C.C., 2014. Specimen collection: an essential tool. - Science, 344(6186): 814-815. https://doi.org/10.1126/science.344.6186.814

WIENS J.J., 2023. How many species are there on Earth? Progress and problems. - PLoS Biol 21 (11): e3002388. https://doi.org/10.1371/journal.pbio.3002388