Matters arising

Shifting baselines and biodiversity success stories

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Attempts to mitigate the biodiversity crisis require effective indicators on the state of nature, and the Living Planet Index[1] (LPI) is an important tool for policy response and for communicating the importance of biodiversity declines to the general public. We welcome the recent analysis of Leung et al.[2], who identified clusters in population trends between 1970 and the present from the LPI and illustrated that previously reported vertebrate declines are sensitive to a small percentage of declining populations. We agree that the disaggregation of indices such as the LPI can provide many useful insights[1], but caution against the over-interpretation of stable or even increasing recent population trends as success stories, because for many vertebrate species, critical losses to populations happened before 1970 (the start date of the LPI). Shifting baselines for conservation success stories need to be confronted if we are to set biodiversity targets that meaningfully represent humans living in harmony with nature for the Post-2020 Biodiversity Framework.

As a result of their analyses, the authors conclude that: "many systems appear to be generally stable or improving." The intent of our response is to illustrate, using some well-known conservation examples, that we should be cautious about interpreting stable or even increasing recent (that is, post-1970) population trends—whether documented via the LPI or elsewhere—as necessarily reflecting conservation success. For many vertebrate species, massive range collapse and critical losses to populations occurred before 1970, which is the arbitrary start date of the LPI[3,4]. The year 1970 is used as a baseline in the LPI because it reflects a compromise between extending the timeline back further and reducing the number of populations included in the index. But because this baseline is both recent and arbitrary, conclusions and interpretations of increasing population trends must be offered cautiously, lest inferences be susceptible to the 'shifting baselines' syndrome[5].

A first indication of this potential problem is illustrated by the fact that the analysis of Leung et al. focuses on rates of population change from 1970, rather than the absolute size of the population or its threat status. Yet, globally, we know there are many species classified as vulnerable, endangered, or critically endangered that nevertheless have apparently stable populations[6]. For example, the Javan rhino (*Rhinoceros sondaicus*) has even increased in population size at Ujung Kulong National Park in Indonesia since 1970, but this is the last remaining population of the species; and with only 62 individuals, this species remains critically endangered[7]. For this species and others like it, a stable population trend since 1970 is thus not at all equivalent to a conservation success story, as in absolute terms these are small populations that are still highly susceptible to extinction. This point is critically important, because the work by Leung et al. could easily be misinterpreted by policy makers as evidence that, but for 1% of populations, on average the planet's biodiversity is "doing ok."

The shifting baseline problem can be further illustrated by extending the series of population counts back in time from 1970. Population data are less accurate the further back in time you go, but estimates can be derived from a range of sources, including observations, population reconstruction using an ecological or demographic analysis, species distribution models and population genetics. We know that for many vertebrates for which we have longer time series estimates[8–10], rates of recent change are dwarfed by the declines in population numbers that occurred before 1970. And for those species for which we do not have reliable enough historical population estimates, catastrophic range collapses[3,4] can provide an indication of pre-1970 population declines.

Even extending the time series of population counts backwards by several hundred years provides a clear illustration of the shifting baseline problem in conservation. For example, African elephants (*Loxodonta africana*)[9,11] are thought to have declined from about 25 million to about 1 million between 1800 and 1970, at a rate of 1.4 million per decade, compared to just 0.13 million per decade over 1970–2016. Moreover, tiger (*Panthera tigris)* populations in India, which have shown signs of recent increase due to conservation efforts, still number fewer than 3,000 individuals[8], just 7% of their former counts at the turn of the twentieth century[12]. Similarly, the Iberian lynx (*Lynx pardinus*) while seeing roughly a tenfold increase in their population over the past two decades, today still represent just 8% of their former population two centuries ago[10]. Finally, bison (*Bison bison*) now number only about 500,000 individuals compared to the millions that previously ranged across North America, and occupy less than 1% of their pre-European colonization range, despite an increasing population trend since 1970[13].

Such shifting baselines pose important questions for what we perceive as conservation successes. These questions are highly relevant to local and national governments and policy makers, and also at the international level for bodies and processes such as the Convention on Biological Diversity, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Post-2020 Biodiversity Framework. A long-term ecological perspective on species conservation is of fundamental importance to ensure that suitable baselines are set for assessing biodiversity recovery. As such, a suite of metrics should be considered together to account for both wins in short-term conservation efforts (which of course should be celebrated where they occur), and also the bigger wins of extinction rate reversals and reductions in the number of populations and species that are endangered[2].

Most importantly, however, the problem of shifting baselines in conservation needs to be confronted if we are to co-create, monitor, and

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track progress on biodiversity targets which aim to support a thriving and flourishing planet—rather than ones that 'successfully' maintain the earth in an already much-degraded state.

1. Almond, R. E. A., Grooten, M. & Petersen, T. (eds) *Living Planet Report 2020 – Bending the Curve of Biodiversity Loss* (WWF, 2020).
2. Leung, B. et al. Clustered versus catastrophic global vertebrate declines. *Nature* **588**, 267–271 (2020).
3. Deinet, S. et al. *Wildlife Comeback in Europe: The Recovery of Selected Mammal and Bird Species* (final report to Rewilding Europe by ZSL, BirdLife International and the European Bird Census Council) (2013).
4. Ceballos, G., Ehrlich, P. R. & Dirzo, R. Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines. *Proc. Natl Acad. Sci. USA* **114**, E6089–E6096 (2017).
5. Pauly, D. Anecdotes and the shifting baseline syndrome of fisheries. *Trends Ecol. Evol.* **10**, 430 (1995).
6. Daskalova, G. N., Myers-Smith, I. H. & Godlee, J. L. Rare and common vertebrates span a wide spectrum of population trends. *Nat. Commun.* **11**, 4394 (2020).
7. Setiawan, R. et al. Preventing global extinction of the Javan rhino: tsunami risk and future conservation direction. *Conserv. Lett.* **11**, e12366 (2018).
8. Mondol, S., Bruford, M. W. & Ramakrishnan, U. Demographic loss, genetic structure and the conservation implications for Indian tigers. *Proc. R. Soc. Lond. B* **280**, 20130496 (2013).
9. Milner-Gulland, E. J. & Beddington, J. R. The exploitation of elephants for the ivory trade: An historical perspective. *Proc. R. Soc. Lond. B* **252**, 29–37 (1993).
10. Casas-Marce, M. et al. Spatiotemporal dynamics of genetic variation in the iberian lynx along its path to extinction reconstructed with ancient DNA. *Mol. Biol. Evol.* **34**, 2893–2907 (2017).
11. Chase, M. J. et al. Continent-wide survey reveals massive decline in African savannah elephants. *PeerJ* **4**, e2354 (2016).
12. Jhala, Y. V, Qureshi, Q. & Nayak, A. K. (eds) *Status of Tigers, Co-Predators and Prey in India 2018. Summary Report* (National Tiger Conservation Authority, Government of India, New Delhi & Wildlife Institute of India, 2019).
13. Sanderson, E. W. et al. The ecological future of the North American bison: conceiving long-term, large-scale conservation of wildlife. *Conserv. Biol.* **22**, 252–266 (2008).

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