Matters arising

Shifting baselines and biodiversity success stories

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ARISING FROM B. Leung et al. *Nature* https://doi.org/10.1038/s41586-020-2920-6 (2020)

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.

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Additional information
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Reply to: Shifting baselines and biodiversity success stories

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REPLYING TO Z. Mehrabi & R. Naidoo *Nature* https://doi.org/10.1038/s41586-021-03750-6 (2022)

In the accompanying Comment[1], Mehrabi and Naidoo argue that the conservation usefulness of the Living Planet Database (LPD) is limited by its recent timeframe. We thank Mehrabi and Naidoo for their comments, and welcome discussion about the conservation implications of global population trends. We preface our response by stating that we unequivocally agree that ongoing conservation is critical for safeguarding Earth's biodiversity, and (re)emphasize that our results do not suggest that the planet's vertebrates are "doing ok." Our paper[2] shows that there are widespread declines in many vertebrate populations, and we identify where these are most severe. These declines are not negated by our finding that other systems are broadly improving. We report both increases and decreases to provide a balanced characterization of the data. We are upfront in the abstract that the data and results are for recent time-scales: 1970 to the present.

We raise two points about this the arguments presented in the Comment[1]. First, while we agree that 'shifting baselines' are a real conservation concern, and we support analyses that include pre-1970 population sizes (when those are available), trends in recent decades are also highly relevant to conservation policy. Since 1970 there has been an accelerating global environmental movement, matched to some extent by legislation and policy, particularly in the global north. At the same time, the world has seen increases in globalization, per capita consumption, and human population size. We need to understand trends over recent time frames to understand where (and potentially why) we are moving in the right direction and where we are not.

Second, assessments of population change should be anchored by data, and empirical estimates of populations are more widely available over relatively recent timeframes. While we also value indirect proxies (for example, expert opinion or species distribution models), they also have limitations that should be acknowledged; these proxies do not replace and should not be confused with direct trend estimates. If we want to engage in broad global comparisons we need broad global data, and the LPD is the most comprehensive dataset on animal population trends available.

Mehrabi and Naidoo are also concerned that populations that have been stable since 1970 will be over-interpreted as a conservation success, pointing to examples such as the Javan rhino, Iberian lynx and North American bison that experienced large declines before 1970 and have recently improved but have not yet recovered. We wholeheartedly agree that more conservation action is needed, but disagree that scientists should downplay successes. After massive population declines up to 1970, the most likely fate of a population would surely have been further decline. It is a success story when populations increase tenfold (Iberian lynx) or to substantial numbers (around 500,000 bison). For the critically endangered Javan rhino, preventing extirpation across five decades is a heroic feat that required substantial conservation investment, and each animal added should be celebrated as a success story in this context. Conservation is a long and hard game: we can celebrate wins while recognizing that more investment towards recovery is needed.

Finally, Mehrabi and Naidoo argue that we should guard against the misinterpretation that, "but for 1% of populations, on average the planet's biodiversity is doing ok." We strongly agree—for this reason, both our abstract and paper highlighted where broad-scale declines are occurring. Just because more systems were improving than declining does not obviate the need for conservation; improvements in one region (for example, Europe) do not negate the importance of losses in others (for example, Asia).

Our finding that 'not everything is declining' in no way implies that conservation is no longer needed. Beyond the few extreme populations, we explicitly highlighted that the aggregate trend masked variation and important declines in the remaining 98.6% of populations. Of the world's 57 taxa–region systems, ten (17.5%) showed evidence of strong systematic decline, within which 87% of populations were strongly declining. Seven of the ten declines had high uncertainty, but this highlights systems that urgently require better data. Here, precautionary policies would be appropriate. Even in the stable or increasing systems, around 15% of populations were also experiencing strong declines, and these populations could be the targets of conservation action.

In summary, considerations of historical baselines and contemporary trends are complementary. Within the trend data, our paper shows that almost one-fifth of Earth's systems and 15% of populations in the remaining systems have declined in recent decades; it is only in the context of previous apocalyptic estimates that such numbers could seem marginal.

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