Received: 26 February 2021 | Accepted: 11 March 2021

DOI: 10.1111/conl.12801

Conservation Letters
A journal of the Society for Conservation Biology
Open Access
WILEY

CORRESPONDENCE

Can simultaneously operating threats predict extinction risk in vertebrates?

In a recent contribution, Greenville et al. (2021) elegantly use network analyses to investigate the relationship between threat diversity and extinction risk in vertebrates. We applaud the use of this new method, but question the authors' conclusions.

Contrary to results from previous studies (e.g., Ducatez & Shine, 2017; González-Suárez & Revilla, 2014; Jono & Pavoine, 2012), Greenville et al. (2021) conclude that "extinction risk is not higher for species exposed to a greater number of threats" (except for cartilaginous fishes). We suggest that methodological problems weaken this conclusion.

First, research effort is one of the main predictors of threat diversity; the more research that an imperiled species attracts, the greater the number of likely threats identified (Allek et al., 2018; Ducatez & Shine, 2017). Species that are endangered also tend to be investigated less often (Ducatez & Shine, 2017) and hence will (paradoxically) be allocated fewer threats. To take this bias into account, previous analyses have included proxies of research effort. Similar corrections could be implemented in the network analysis framework by correcting the number of species per threat category by proxies of research effort, or by excluding poorly known species.

Second, most previous studies have grouped IUCN threats into a small number of categories, thereby limiting biases in threat identification due to the data available (Hayward, 2009). By considering 39 different categories (vs. less than 12 in most previous studies), the analyses of Greenville et al. (2021) are exposed to biases in threat assessment.

Third, the results of Greenville et al. (2021) do not account for interspecific variation in geographic range size. Species with broader ranges tend to be exposed to more threats, while also being at lower risk (range size is a major criterion for assessing extinction risk). Thus, we need to remove the potential effect of range size by incorporating it as a covariate, and excluding species listed as at risk because of their small range (e.g., Ducatez & Shine, 2017; González-Suárez & Revilla, 2014).

In conclusion, network analyses can be valuable but at this stage, most studies show an increase in global extinction risk as the number of threats increases. We believe that more robust network analyses, correcting for biases in threat assessment and considering range size, would bring additional insights on this fundamental question.

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REFERENCES

Allek, A., Assis, A. S., Eiras, N., Amaral, T. P., Williams, B., Butt, N., Renwick, A. R., Bennett, J. R., & Beyer, H. L. (2018). The threats endangering Australia's at-risk fauna. *Biological Conservation*, *222*, 172–179.

Ducatez, S., & Shine, R. (2017). Drivers of extinction risk in terrestrial vertebrates. *Conservation Letters*, *10*, 186–194.

González-Suárez, M., & Revilla, E. (2014). Generalized drivers in the mammalian endangerment process. *PLoS One*, *9*, e90292.

Greenville, A. C., Newsome, T. M., Wardle, G. M., Dickman, C. R., Ripple, W. J., & Murray, B. R. (2021). Simultaneously operating

threats cannot predict extinction risk. *Conservation Letters*, *14*, e12758.

Hayward, M. W. (2009). The need to rationalize and prioritize threatening processes used to determine threat status in the IUCN red list. *Conservation Biology*, *23*, 1568–1576.

Jono, C. M. A., & Pavoine, S. (2012). Threat diversity will erode mammalian phylogenetic diversity in the near future. *PLoS One*, *7*, e46235.

How to cite this article: Ducatez, S., Shine, R. Can simultaneously operating threats predict extinction risk in vertebrates?. *Conservation Letters*. 2021;*14:*e12801. https://doi.org/10.1111/conl.12801