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“Insectageddon”: a call for more robust data and rigorous analyses

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As members of that subset of the human population who love insects, we have been alarmed by a recent publication reporting their global decline and impending extinction (Sánchez-Bayo & Wyckhuys 2019), and the accompanying media furore. Indeed, there has been a growing tide of concern over the magnitude and potential consequences of diminishing insect populations (e.g., Hallmann et al. 2017; Lister & Garcia 2018). However, we respectfully suggest that accounts of the demise of insects may be slightly exaggerated. Bad things are happening – we agree – but this is not the whole story. We call for hard-nosed, balanced and numerical analysis of the changes taking place, and for calm and even-handed interpretation of the changes, rather than rushing headlong into the hyperbole of impending apocalypse.

Reports of insect declines come as no surprise to entomologists; this has been familiar territory for many decades (Leather 2019). The latest article by Sánchez-Bayo & Wyckhuys (2019) makes a substantial and valuable contribution to the field, bringing together many of the individual studies in one review. However, considerable uncertainties and potential biases remain.

A key problem stems from the ‘Methodology’ section, which states “…. we performed a search on the online Web of Science database using the keywords [insect*] AND [declin*] AND [survey]……” Using the search term [declin*] immediately biases the meta-analysis towards exaggerated estimates of decline rates, even assuming there is no underlying publication bias in the literature. An unbiased review of the literature would still find declines, but estimates based on this “unidirectional” methodology are not credible.

Extrapolation from measured rates of decline to extinction then has four further and currently unresolved challenges, which are associated with translating rates of change across types of data, spatial scales, locations, and durations.

Nearly all ‘disappearances’ of insect species reported in the literature represent losses of species from individual sites or regions, but it requires quite different data and calculations to extrapolate to the extinction of species at larger spatial scales. Many British insect species have declined massively at a local level, but most of them still survive somewhere in Britain and even fewer are endangered at a European spatial scale. Furthermore, a preponderance of data come from Europe and North America, as Sánchez-Bayo & Wyckhuys (2019) highlight. Trying to extrapolate from population or biomass declines over several decades, or from threatened species lists, in 'developed' temperate zone countries to, say, 100-year species-level extinctions of undescribed endemics confined to the precipitous eastern flanks of the Andes does not wash. A far more sophisticated approach is required if we wish to estimate global extinction rates.

Many studies find that abundances, biomass or species richness are declining in some locations, but not everywhere, and some species are declining but others are not. For example, Shortall et al. (2009) reported declines in flying insect biomass at one of four sample sites over a 30-year period, while Fox et al. (2014) reported that, while 260 British moth species declined, 160 increased significantly. In both cases, extrapolating the average rate of decline to a future zero-biomass or zero-species world would clearly not be appropriate, since declines are not evident at many sites and for many species. The idea that there will be hardly any insect biomass or species left in the world in 50 to 100 years is misleading. Dynamism of the biological world is sufficiently great (particularly now) that the arrival of new species and increases in some of the species already present must be factored into estimates of future prospects for biomass and biodiversity.

Given the headline statements in the original articles, it was not surprising that the media reported the apocalypse with some enthusiasm! Interestingly, the BBC (McGrath 2019) and others reported that we will have plagues of insect pests instead, which bears almost no relation to the data presented in the paper. Even if pests increase in future, there is scant evidence that this will be predominantly because of the decline in other insect species.

The authors concluded that "Habitat restoration, coupled with a drastic reduction in agro-chemical inputs and agricultural 'redesign', is probably the most effective way to stop further declines, particularly in areas under intensive agriculture." We fully appreciate the importance of developing sustainable approaches to agriculture, and have contributed to this active area of research (e.g., Pretty et al 2018). But we also recognise that crop pests and diseases, many vectored by insects, currently cause 35% yield losses, and can rise to 70% in the absence of pesticides (Popp et al. 2013). Since agriculture is already the proximate driver of 80% of deforestation (Kissinger et al. 2012), any solutions to the current "crisis" which require additional farmland to maintain food supplies may exacerbate some of the problems for global insect conservation. Joined-up thinking is required.

In conclusion, robust data are needed from all parts of the world to assess the status and trends of insect abundances, biomass, species richness, and the functions (beneficial and harmful to humans) they perform. Ultimately, this requires a step-change in funding (Leather 2019). Hyping-up the situation based on incomplete and potentially biased data may generate necessary short-term attention, but it could ultimately backfire if it subsequently turns out that some of the claims have been exaggerated.

We declare no conflict of interest.

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