

Still not enough taxonomists: reply to Joppa *et al.*

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Taxonomists are people who describe species. This work is essential for the conservation of biodiversity and for estimating how many species there are left to be discovered, the so-called missing species [1]. However, it has been claimed the science of taxonomy is in crisis [2] because researchers are afraid that the number of people describing new species is in decline [3,4]. In a recent letter in *TREE*, Joppa and co-workers show that, contrary to this common belief, the number of taxonomists actually increased exponentially over the last 60 years with respect to all taxa they investigated (plants, spiders, cone snails, amphibians, birds, mammals) [5]. By contrast, the number of species described per taxonomist has declined since about 1900 in all but one taxon (cone snails), which is indicative of a diminishing pool of missing species. This decline in per-capita rates of description of new species can now be used to estimate the total numbers of species that there are on earth [1,6]. However, because Joppa and colleagues only analysed rather well-studied taxa, they question if the pattern they found is representative for more poorly known, species-rich groups such as beetles and parasitic wasps [5].

Here I analysed two databases for the two major superfamilies of parasitic wasps [7,8], the Chalcidoidea and the Ichneumonoidea, and found that the number of taxonomists

describing species in these two groups has increased roughly exponentially for almost the last 250 years, since the very beginning of parasitic wasp description (Figure 1a). However, in contrast to more well-known taxa, there has been no sign of decline in the number of parasitic wasp species described per taxonomist since at least 1940 (Figure 1b), which indicates that the pool of missing species yet to be discovered is not limiting the rate of description of new species. Thus, in these two speciose but more poorly known groups, it is not possible to use the decline in description rates per taxonomist to make reliable estimates of how many species there are.

An exponentially increasing number of taxonomists for almost all taxa seems to suggest that taxonomy is not in crisis. However, even after more than 250 years of taxonomic study the increasing number of taxonomists is not enough to allow estimation of how many species there are still left to be discovered in speciose but less-well studied taxa such as beetles [9] and parasitic wasps, two groups that comprise a major fraction of all the species on earth [10]. It is commonly agreed that at current rates of extinction, many species will die out before they are described by science [3,11]. This is tragic in itself, but it also means that with the current gap in our knowledge of how many species

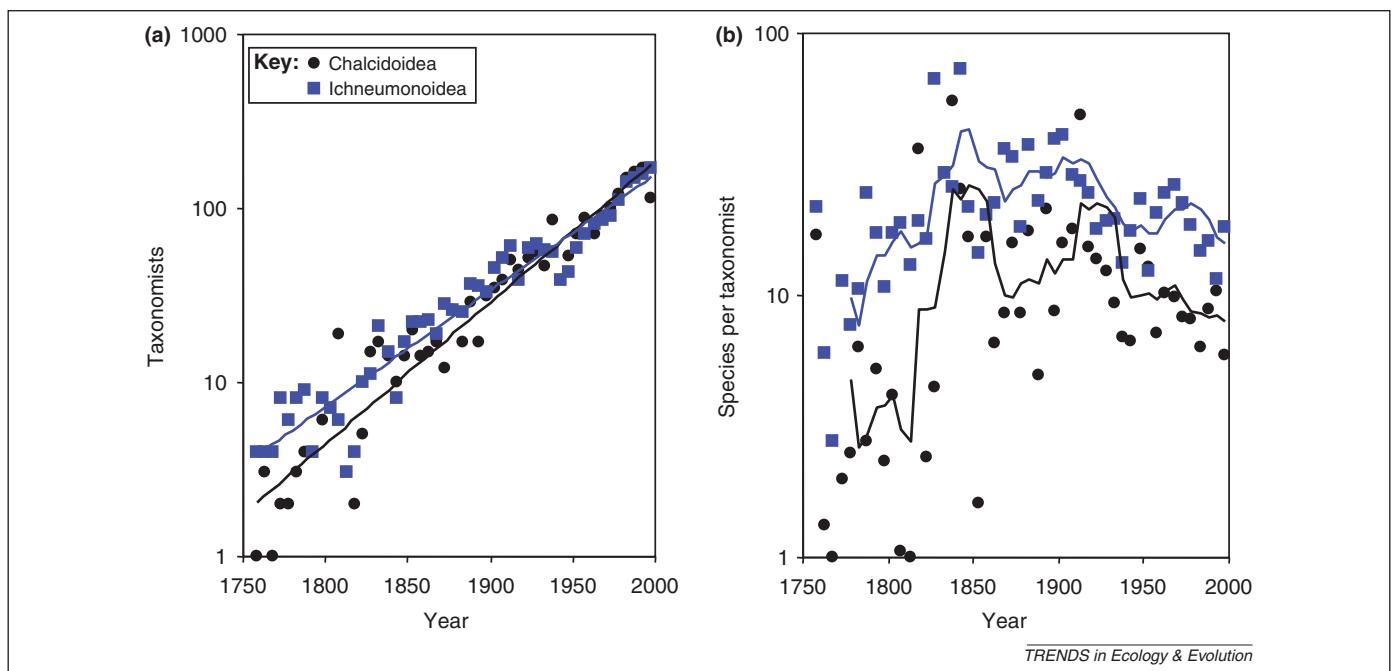


Figure 1. Trends over time for (a) the number of taxonomists involved in species descriptions in 5-year intervals (exponential curve fit; Chalcidoidea $R^2 = 0.91$; Ichneumonoidea $R^2 = 0.92$) and (b) species described per taxonomist (lines show the 5-period moving average) for the two major superfamilies of parasitic wasps.

there are in different taxa, it is probably impossible to estimate rates of species extinction in poorly known species taxa. This makes it difficult to develop reasonable conservation priorities [6] and certainly impossible to quantify their effectiveness. Taxonomists may not be dying out, and their numbers may even be rising exponentially, but this does not mean that taxonomy is not in crisis. Even though taxonomists have continually adopted modern technological advances, the per-capita rates of species description did not increase over the last 60–70 years. We still need to describe species at a much faster rate than we currently do; we still need more taxonomists.

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