Bionomina, **12**: 39–43 (2017)
http://www.mapress.com/j/bn

Article

ISSN 1179-7649 (print edition)
BIONOMINA
ISSN 1179-7657 (online edition)

https://doi.org/10.11646/bionomina.12.1.3
http://zoobank.org/urn:lsid:zoobank.org:pub:D963F99F-EA55-4D1E-A020-BD92030EE922

Assessing biodiversity: a pain in the neck

Ivan LÖBL

Muséum d'histoire naturelle, Geneva, Switzerland. <*ivan.lobl@bluewin.ch*>.

Abstract

Though taxonomic studies provide basic information about the diversity of life, they are often impeded by unfounded beliefs, anthropomorphic feelings, inadequate information of decision holders, and threatened by the activities of some zoologists and conservationists. Two such threats are discussed. One is latent, derived from the provisions of the *International Code of Zoological Nomenclature*. The second is actual/effective, caused by technocratic restrictions limiting field work. The present trends lack a rational foundation, are counterproductive and risk producing negative impacts on efforts to extend conservation of natural sites.

Key words: Biodiversity; taxonomy; conservation; nomenclature.

Introduction

The study of life has to face two major challenges, the understanding how it works and the assessment of forms of living things that occur, or have occurred, on our planet. The former study, functional biology, turned out to be a source of numberless applications, many of them granting short term profits and has consequently been supported (financially, institutionally). The second, organismal biology, provides us with information about the surrounding world. It tends to answer questions related to the diversity of organisms, their interactions, evolution and history. Though essential for our knowledge, such information is not necessarily a source of short-term profits.

Taxonomy is the field that deals with organismal biology and defines discrete units of life, provides means for their identification, places them within a framework of other organisms (e.g., Wiley 1981), and, by extension, generates information about their distributional pattern(s), analyses their relationships and establishes hypotheses about their evolution. Related fields, such as ecology, biogeography and phylogeny, are, in the absence of sound taxonomy, meaningless. In addition, parasitology, forestry and agriculture would be considerably affected by the absence of information coming from taxonomic studies, as only a reduced number of the most important sources of diseases and pests could be reliably identified. Outsiders, including many zoologists, sometimes only see the end result of taxonomical studies, the names (designation labels) of taxa, and, following a strange intellectual shortcut, consider that naming biodiversity is the aim of taxonomy (e.g., Costello *et al.*

2013). Such opinions are in fact as strange as if one were to consider naming diseases to be the aim of physicians, or naming stars and galaxies the aim of astrophysicists.

Nonetheless, zoo-taxonomists have faced decreasing resources over the last three decades (Wheeler 1995) and often have the impression of being considered a fifth wheel in biology. Zoo-taxonomy has survived several hard blows, some coming from within its own community. Among them the New Synthesis focusing on populations and already relegated to the history of sciences, and the more recent belief in the reliability of a single and universal molecular marker that may be used to define species (and replace knowledge of their other features), as suggested by the Barcoding movement. In the present paper, two other threats to taxonomy are discussed, one latent, and the other very much real and present.

Threats

The latent threat

As previously stated, taxonomy deals with taxa, i.e. the formally recognised discrete units of life. Taxa represent hypotheses that evolve depending on available information and tools used to interpret or analyse data. This fact explains the uninterrupted flow of changes affecting the names of taxa and their classification, since the origin of taxonomy in mid-eighteenth century. A universal language, nomenclature, was established to face these inherent problems. It is considered a guarantor of the unambiguous purvey of information in zoology, and regulated by the International Commission of Zoological Nomenclature. The currently valid nomenclatural rules are given in 90 Articles and many 'sub-articles' in the *International Code of Zoological Nomenclature* ('the *Code*'; Anonymous 1999), and all of them are binding for every user of scientific animal names.

Taxonomists, at least the numerous ones known to the author of these lines, consult individual rules of the *Code* in case of doubts, and it looks like only a minute fraction of them becomes familiar with all of the included provisions. A typical example of this situation is given by Article 73 of the *Code* which, with its sub-article 73.1.4, allows one to establish new species in the absence of voucher specimens. Several conspicuous, very rare vertebrates considered new to science have been established in this manner, an event that has hardly been noticed by the broader community of taxonomists focusing on invertebrate animals. The situation changed after the recent publication of a paper by Marshall & Evenhuis (2015) who widely publicized Article 73 of the *Code* and, unintentionally, raised a world-wide protest movement. Dubois (2017) discusses all the problems caused by application of a rule that permits virtual taxonomy in detail. Nevertheless, it may be useful to point to the following associated facets.

Hard science requires verification and/or possible refutation of established data and of hypotheses (Popper 1959). This is not, and cannot be, guaranteed in the case of illustrations, produced on unique occasions, and used as a replacement for physical specimens. Photography may show reality exactly, or with some modifications, or be an artefact. A 'science' that applies methodology based on unverifiable and non-refutable data is simply not a hard science, or not a science at all. This fact may have a major impact on decision holders who dispose of resources, and who, as is the case with most biologists, have not been previously informed about the idiosyncrasies of taxonomy. It is simply unfair to penalise a community of many thousands of taxonomists in order to satisfy a few individuals who desire to publish descriptions of species that have not been sampled. The frustration is amplified by the fact that the entire discipline of taxonomy may be threatened just because it provides for such a possibility when establishing formal scientific names (i.e., labels), while all available biological information may be readily published.

The direct threat

A drastic decline of populations and species richness is observed almost everywhere and by everyone. So far, only some 90,000 species are listed by the IUCN Red List of Threatened Species. Yet as many as 30 % of them are already found to be effectively threatened and the number of recent documented extinctions is likely a significant underestimate (www.iucnredlist.org). The factors responsible for global biosphere pauperisation are complex and multiple: among the most important to be identified are deforestation, pollution (including lightning), intensive agriculture, dessication of humid sites, drainage of waterways and invasive species. A minute proportion of all total land surfaces is protected from this ever-increasing anthropic pressure, mainly thanks to the efforts of conservationists. Such protected areas with conserved original faunas and floras may be compared to islands, emerging from devastated landscapes. They resist short-term economic pressure and so, hopefully, assure a future for hundreds of thousands of species. The establishment of protected sites would require lobbies to counterbalance local economic myopia, and lobbies may only respond to robust reasoning: except for reserves established to protect very large and spectacular animals, the rationale for the conservationist is provided by taxonomists who identify unique species-richness at specific sites.

While large animals can be observed in situ, or their traces may be easily detected, small animals, the bulk of terrestrial biodiversity, are inconspicuous and not easy to identify. Modern taxonomists use a variety of methods to obtain significant samples of small animals (such as a variety of traps, forest floor litter extractors, canopy fogging, etc.). Experts in the field use those methods that are best suited for the groups they intend to study, and as a by product they collect other species present in the samples, which often prevail in terms of the number of taxa and specimens. The collected material is subsequently mounted, labelled, sorted to taxonomic subunits, and finally studied and identified by experts. Information about the existence of the overwhelming number of known animal species has been so obtained.

For some reasons sampling has come to be associated with killing, and the non-comparability of large vertebrates that reproduce slowly vs. minute, rapidly reproducing invertebrates came to be ignored. An almost worldwide net of regulations impeding sampling has been implemented, with the rationale of 'avoiding pauperisation of biodiversity'. Unfortunately, the promoters of these restrictions seem to have overlooked the uncomfortable fact that only preserved habitats may provide a guarantee for the survival of species. As a result of regulations, the flow of new information about diversity of life in previously unexplored or not sufficiently explored sites is weakened or even broken. The chance to assess further vast areas of unknown species, which are estimated to exceed the number of all known ones by four to five times, is now decreasing significantly, just as are the chances to provide new hard data potentially useful for conservation issues. Thus, paradoxically, regulations promoted by conservationists are a 'placebo' working against their own interests, while the destruction of habitats progresses unabated. Another quite negative effect of these current trends is the fact that they induce an aversion of young people towards organismal biology, which often requires the examination of conserved (i.e. killed) specimens. This may at least partly explain the drift of biology students from field work and a holistic view of animals to laboratory work and fragmentary views. At present, sampling a bumble bee for study is condemned, while planting exotic lime trees that permanently kill bumble bees

(Illies & Mühlen 2007) is not a matter worthy of criticism. How ill-founded these feelings and ideas about sampling and killing insects and many other animals may be is demonstrated by the following couple of examples:

[1] A single average large colony of the greater mouse-eared bat *Myotis myotis* (Borkhausen, 1797) annually kills 2,250,000 to 2,800,000 ground beetles (Carbonnel & Moeschler 2001), i.e. more than 2,200 specimens/km^2, in Switzerland. About 130 colonies of this bat species in Switzerland (Möschler pers. comm.) kill at least 300 million Swiss ground beetles per year, while two centuries of collecting has resulted in less than one million ground beetles being preserved in collections in Switzerland (Marggi pers. comm.). As the greater mouse-eared bat is wide spread in Europe and the Near East, and since they have been preying on beetles for ever, the total number of beetles killed by this single predator is frankly astronomical.

[2] Seven songbirds during breeding season kill as many insects in a single week as an average entomologist kills during his entire lifetime (Geiser 1988).

[3] In Austria, in the 1970s, cars killed annually 14×10^{15} insects (Gepp 1973; Klausnitzer 2000). This number exceeds the estimated number of all animals preserved in collections worldwide, assembled since the 18th century, by 5 million times (Kemp 2015).

Obviously, populations of insects, as of many other animals, are not permanently impacted by their numerous predators (or parasitoids, or diseases), and the sampling of specimens by researchers and collectors is frankly negligible compared to natural events (though some populations of spectacular insects became fragilized by the egocentrism of a few collectors). Quite unlike these effects, pollution or the destruction of habitats does indeed have a permanent impact and results in extinctions.

The restrictions that ignore these realities have reached paroxystic levels since governments aligned with the Nagoya Protocol. The Protocol is concerned with the fair and beneficial sharing of genetic resources and is therefore a positive initiative. The problems derive from bureaucratic interpretations and requirements that one encounters in many countries, a decisional shortcut when having to address issues regarding organisms needed as samples of taxa and their potentially useful genetic properties, and the absence of adequate taxonomic expertise in many places of the world. Taxonomists who undertake field trips with the purpose of increasing knowledge of global biodiversity are used to making do with limited resources, the risk of diseases and poor accommodation often combined with defective diets. What is harder to accept is devoting a significant part of one's allocated resources in responding to local bureaucratic requirements, a limited access to sites, an obligation to collaborate with non-existing local experts, having to limit the sampling to a fraction of taxa mentioned on permits (leaving so many trapped individuals of unknown species in situ as an ant food), and the obligation of returning a significant part of the specimens one has studied to inadequately functioning institutes (personal experiences, and that of many colleagues). While we experience many of the negative impacts of these circumstances as individuals, individual taxonomists and collectors interacting with individual officials, bureaucrats and enforcers in other countries, actually many of ultimate causes of these "micro-dynamics" are due to much more encompassing economic, social and cultural factors. And individuals and single institutions often have (very) limited control over them.

It is perhaps time to recognize the value of knowledge of organisms, to subordinate the provisions of the *International Code of Zoological Nomenclature* to its needs and to replace restrictions by tools that stimulate research and are useful for conservation needs.

Acknowledgements

My cordial thanks are due to Alain Dubois, Paris, and Mark Epstein, Ewing (USA), for comments, and to Werner Marggi, Thun, and Pascal Moeschler, Geneva, for providing unpublished information.

References

Anonymous [International Commission on Zoological Nomenclature] (1999) *International code of zoological nomenclature*. Fourth edition. London (International Trust for zoological Nomenclature): i–xxix + 1–306.

Borkhausen, M. B. (1797) *Deutsche Fauna oder kurzgefasste Naturgeschichte der Thiere Deutschlands.* Erster Theil. *Säugerthiere und Vogel*. Frankfurt am Main: i–xxiv + 1–620. <https://doi.org/10.5962/bhl.title.58727>.

Carbonnel, J.-P. & Moeschler, P. (2001) Petite contribution au problème de la protection de l'entomofaune. *Le Coléoptériste*, **42**: 91–94.

Costello, M. J., May, R. M. & Stork, N. E. (2013) Can we name earth's species before they go extinct? *Science*, **339**: 413–416. <https://doi.org/10.1126/science.1230318>.

Dubois, A. (2017) The need of reference specimens in zoological taxonomy and nomenclature. *Bionomina*, **12**: 4–38. <https://doi.org/10.11646/bionomina.12.1.2>.

Geiser, E. (1988) Der Entomologe – ein Schädling oder ein Nützling? Quantitative und qualitative Überlegungen zu den Artenschutzverordnungen. *Natur und Land*, **1**: 2–8.

Gepp, J. (1973) Kraftfahrzeugverkehr und fliegende Insekten. *Natur und Landschaft*, **59**: 127–129.

Illies, I. & Mühlen, W. (2007) Late blooming lime trees (*Tilia* spec) (Hymenoptera: Apidae) [Das Sammelverhalten von Honigbienen an spätblühenden Linden]. *Entomologia generalis*, **30**: 155–165.

Kemp, C. (2015) The endangered dead. *Nature*, **518**: 292–294. <https://doi.org/10.1038/518292a>.

Klausnitzer, B. (2000) Entomofaunistik an der Schwelle zum 3. Jahrtausend. *Entomologica basiliensia*, **22**: 61–74.

Marshall, S. A & Evenhuis, N. L. (2015) New species without dead bodies: a case for photo-based descriptions, illustrated by a striking new species of *Marleyimyia* Hesse (Diptera, Bombyliidae) from South Africa. *Zookeys*, **525**: 117–127. <https://doi.org/10.3897/zookeys.525.6143>.

Popper, K. (1959) *The logic of scientific discovery*. London (Hutchinson): 1–513. <https://doi.org/10.1063/1.3060577>.

Wheeler, Q. D. (1995) The "Old Systematics": classification and phylogeny. *In*: J. Pakaluk & S. A. Ślipiński (ed.), *Biology, phylogeny, and classification of Coleoptera, Papers celebrating the 80th birthday of Roy A. Crowson*, Volume **1**, Warszawa (Muzeum i Instytut Zoologii PAN): 31–62.

Wiley, E. O. (1981) *Phylogenetics. The theory and practice of phylogenetic systematics.* New York (Wiley): i–xv + 1–439.

Submitted: 12 February 2017. Accepted: 27 February 2017. Published: 25 March 2017.
Corresponding Editor: Mark Epstein.