Editorial. Assessing Earth's biotic diversity in natural history museums – gone with the wind?

Ivan Löbl

Abstract. Many members of our society ask in formal and informal meetings what is going on in natural history museums and especially in insect collections: little activity, little motivation, and little support. The editor-in-chief of *Phegea* asked an expert in museum insect collections for his opinion. Dr. Ivan Löbl is based at the natural history museum in Geneva and edited an impressive series of catalogues of Palaearctic Coleoptera https://brill.com/display/serial/CPC

Samenvatting. Veel leden van onze vereniging vragen in formele en informele vergaderingen wat er gebeurt in natuurhistorische musea en in het bijzonder in insectenverzamelingen: weinig activiteit, weinig motivatie en weinig ondersteuning. De hoofdredacteur van *Phegea* vroeg een expert in museale insectencollecties naar zijn mening. Dr. Ivan Löbl is gevestigd in het natuurhistorisch museum van Genève en bewerkt een indrukwekkende reeks catalogi van Palaearctische Coleoptera https://brill.com/display/serial/CPC.

Résumé. De nombreux membres de notre société demandent, lors de réunions formelles et informelles, ce qui se passe dans les musées d'histoire naturelle et notamment dans les collections d'insectes : peu d'activité, peu de motivation et peu de soutien. Le rédacteur en chef de *Phegea* a demandé l'avis d'un expert de collections d'insectes de musées. Le Dr. Ivan Löbl est basé au musée d'histoire naturelle de Genève et il a dirigé l'édition d'une série impressionnante de catalogues de Coleoptera paléarctiques https://brill.com/display/serial/CPC.

Key words: Collecting restrictions – Financial grant system – Insect collections — New taxa discovery.

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Introduction

The study of animals and plants was already highly appreciated by the educated classes in the 18th century. The establishment of natural history museums to preserve and display the results of expeditions was a natural outcome. At that time, being a naturalist was to build a great body of knowledge. As a consequence of the work of Carolus Linnaeus, many naturalists devoted their lives to identifying, cataloguing, and classifying species into formal groups: the taxa. Their efforts led to an assessment of nearly two million species of plants and animals. Alongside this, naturalists clarified the life history, functions in ecosystems, relationships, and evolution of many species. As a result, we have an impressive amount of knowledge at our disposal. Nevertheless, experts involved in the study of taxa are challenged by the gaps that exist and which may potentially prove to be of much importance. According to optimistic estimates, hardly a third of the extant species have been assessed and documented by vouchers in collections. Field workers interested in filling gaps in the knowledge of megadiverse organisms in poorly studied areas, such as insects in subtropical and tropical areas, are used to seeing an inexhaustible flow of unknown species in their samples. Nearly every sample of tropical forest floor litter my colleagues and I have collected yielded new, unknown species, and many of them turned out to be quite common and widespread. The ever-increasing extinction rates of populations and species have become of universal concern, as witnessed at the December 2022 Biodiversity Congress in Montreal. The extinctions affect the known and the unknown life; while the latter risks disappearing even before being documented. The fact is alarming as the knowledge of species is the foundation of the studies of the whole living environment. No doubt actions are needed. Paradoxically, while the rhetoric of politicians, heads of institutes, and media used to recognize the importance of assessing species-richness, the practice in institutions often suggests the opposite. Obviously, there is a need to highlight reasons for this trend and to suggest outcomes.

Introduced collecting restrictions

As most organisms cannot be studied in situ, sampling is a prerequisite for advancing knowledge. Nevertheless, administrations have during the last decades introduced restrictions — the same for large and slowly reproducing species as for the small and quickly reproducing ones. Thus, killing a butterfly may be criminalized just as killing a tiger. This strange equation notably affects the study of megadiverse groups. The fact that predators kill in a single day a billion times more small organisms than all those collected by humans in two centuries is ignored. Though the numbers appear astronomical, they are insignificant compared to the loss through drying wetlands, regulation of streams, planting monocultures in extensive areas, contaminating water and soil, and supporting light

pollution (to name just a few from a long list of actions responsible for extinctions). The irrational criminalization of sampling *all organisms equally* leads to the alienation of youth, who prefer laboratory work, shifting them away from a holistic view of organisms, consequently resulting in lost time, energy, and resources to those still trying to fill gaps in the field. An apogee of restrictions has been reached by the more recent Nagoya Protocol promoting fair benefit sharing, but in its application, scientific publications are not considered as a potential benefit available to all. [Comment of the editor: publications, even if they are Open Access, do not conform to all four FAIR principles: Findability, Accessibility, Interoperability, and Reusability]. Though being well-meant, many international initiatives are jointly responsible for the irreparable loss of knowledge.

Financial grant system

The financial grant system usually relies on metrics. It spread over the world in the expectation of enhancing science, whereas it induced problems due to exponentially increasing the number of proposals. The citation numbers per time unit (as the Impact Factor) are used as a measure meant for evaluating the quality of research and researchers. This agenda has perverse effects as it shifts from long-term studies of poorly known organisms to short-term studies in more popular fields. It also leads to time lost while chasing grants and responding to administrative requirements. Despite the DORA declaration (San Francisco Declaration on Research Assessment) and the opinions of leading scientists, the metrics continue to be promulgated. They are likely maintained because using an easy-to-use tool is believed to warrant a correct evaluation in any scientific field by any individual and to provide a basis for fair funding. The problem is global, though some universities and academies, such as the Swiss ones, are throwing metrics overboard.

Collections as archives of life

Museums of natural history are archives of life. Their cultural and scientific input was for generations acknowledged and they enjoyed adequate support. The fact that specimens housed in collections document the occurrence of species in space and time was recognized as important, just as the need for vouchers to verify published data, to provide the basis for unambiguous nomenclature (i.e. to ensure the correct transfer of information), to exhibit variation of features, and to document climatic changes. In addition, they have an enormous potential for providing useful information whenever new technologies are applied. Photography and samples of the genome are sometimes considered as replacements, though these are barely more than a too-small sticking plaster on a too-large wound. With scientific competition increasing, for over half a century, the idea of old-fashioned museums lacking social and scientific benefits somehow became widespread. The management of museums progressively drives to emphasize possession and protection, rather than to use the collections to improve knowledge. This shift is correlated with increasing bureaucracy and less funding. The trend is to continuously withdraw support irrespective of continually growing collections and to push scientists to address non-scientific issues. At present, many squeeze research into their own time. The reality that we know anything objectively about a species because of specimens in collections, seems to be ignored by the decision-makers. A dilemma also derives from the fact that the value of organisms in collections is correlated with the costs of sampling, conservation, and study, unlike artefacts that have their intrinsic value. The use of new technologies, such as bioinformatics and genomics, came to be appreciated in museums, though they may be applied elsewhere just as well, and they are usually disconnected from the assessment of species diversity. In addition to the attractiveness of technology, the trend is possibly stimulated by the easier achievement of metric scores.

The time span between species discovery and description

One of the effects of the present situation is the time span between the discovery of new species in the field and their formal publication. Eleven years ago, the span was found to be 21 years; in my experience, it is significantly longer for some organisms (63 years for some New Zealand alpine beetles, and nearly two centuries for the Chilean shining fungus beetle *Baeocera darwini* Löbl, 2018). Another concern is the significant amount of collected specimens remaining unstudied because of a lack of taxonomists and qualified administrators. [Comment of the editor: technical experts/administrators who could take on the administrative burden, would in this way give more time for researchers to concentrate on their research by applying modern high technological possibilities]. The issue is not only scientific: if we want a better understanding of the diversity of Earth's life, and by extension the functioning of ecosystems, we must change paradigms, regain freedom in research, and say goodbye to the metrics. Let us hope this revolution arrives before it is too late.