PRIMARY INFRASTRUCTURE FOR MAMMALOGY IN THE ANTHROPOCENE

Dire reports suggest that only about 4% of all mammal biomass now living on the planet occurs in wild (vs. domestic) mammal populations, or that 80% of all wild mammal populations already have been lost, or that we may see the extinction of 50% of all mammal species in the next century. Those statistics, for obvious reasons, remain very rough and their key assumptions should be thoroughly tested. Notwithstanding, however, our planet clearly is changing in ways that has had and will continue to have negative impacts on wild mammals and the field of mammalogy (Ceballos et al. 2017). In the Neotropics, we need look no further than the massive impacts of deforestation, hydroelectric dams, and extractive mineral and petrochemical industries or the projected changes from a warming planet. Coincident with these losses, we have seen a significant increase in the number of described mammal species (ca. 15%) in the last 15 years (Burgin et al. 2018). That increase reflects changes in our methodological foundations and toolkits, but also demonstrates the paucity of knowledge we have about one of the most fundamental components of the natural world. Put bluntly, mammalogy does not yet have the ability to report to the rest of the world essential metrics related to: How many species of mammals exist on Earth? How fast are we losing them? Or even questions such as what role mammals may play in devastating zoonotic diseases emerging now (e.g., ebola, zika, hantaviruses) or what zoonotic pathogens can be anticipated in a world of accelerating perturbation and altered interfaces that drive geographic patterns of disease (Brooks et al. 2014)? Given the rapid planetary changes now underway, this is a critical time to reflect on what integrative and transboundary resources are lacking for the field of mammalogy. Collectively we should now begin to build the key infrastructure necessary to leave the next generation of scientists with the tools they will need to anticipate, monitor and mitigate change as they attempt to meet critical societal needs (Schindel and Cook 2018).

One aspect of that infrastructure that could be substantially invigorated immediately should be expanded archival sampling (i.e., biorepositories) of mammalian diversity and their associated parasites (i.e., holistic specimens). Historically, museum collections have provided critical infrastructure for mammalogy and that central role will expand in coming decades as new technological advances (e.g., genomics, microCT scanning, isotopic analyses, microbiome assays) are applied to specimens (McLean et al., 2016, Greiman et al, 2018). Surprisingly, the vast majority of current research using museum samples is quite different from the original reason the specimens were collected. New research avenues are producing large data streams that will need to be integrated and it is likely that future mammalogists will use the emerging informatics infrastructure provided by museums to store and manage data derived from specimens using new technologies. Museums now are linking their digital resources, essentially becoming a Global Museum. Already some are facilitating the linkage of genome-scale data to sophisticated spatial analyses conducted on GIS platforms. This concept of the specimen as a “data nexus” also provides a powerful opportunity for educators to train the next generation of scientists (Cook et al., 2014) by having these students ask their own questions about mam-
mals and then access museum resources to find answers (or importantly learn about the limits of our knowledge). For many species, archived material in mammal collections will become all that physically remains of their evolutionary legacy. Those specimens, much like fossil specimens for paleontologists, will be the primary source material for generating data for issues related to economics, human health, food safety, drug/medicine discovery or for new questions such as: What impact do potential toxins, such as microplastics, have on marine and terrestrial mammals? For questions related to temporal or spatial scales of change, museum collections can provide exquisite insight into baseline conditions, but only if they are built to be site-intensive, spatially broad, and temporally deep collections. Such collections require trained workers and thoughtful consideration about site selection, appropriate partners, long-term commitment and other considerations. In the immediate future, the scientific community, administrators, foundations, public and private agencies, NGOs, and policy makers in Latin America might consider coordinated (i.e., international) efforts to develop and implement a plan to significantly expand their mammal (and other organismal) collections and improve web-accessibility to ensure the continued development of this key foundation for science in the coming decades. Indeed, Latin American museums could lead a revitalization effort to build this infrastructure, one that is needed worldwide, and one which is no longer being met by some of the leading institutions in Europe or North America (Malaney and Cook 2018).

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LITERATURE CITED