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ESA Position Statement on the Importance of Entomological Collections

Approved on January 11, 2016
Valid through January 11, 2020
Retired December 9, 2019

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The Entomological Society of America (ESA) and its members recognize the value of entomological collections and the staff that maintain them as a rich source of specimens and data for modern research and an irreplaceable historical reference for all of entomological science. It is of vital importance to current and future life scientists that we implement protections for these irreplaceable resources, upon which the bulk of our scientific knowledge relies.

Of the estimated 3 billion specimens housed in biological collections worldwide, approximately 500 million are preserved in U.S. and Canadian entomological collections at government agencies, universities, and in public museums and private collections. The costs of preparing, curating, maintaining, and providing access to these collections are relatively low compared to the devastating impact not doing so would have on the global scientific community. The significant historical investment in collections that established America's scientific leadership in the biological sciences is at risk, and our reputation and competitive edge in the biological sciences could diminish if steps are not taken to ensure the future of this natural resource through continued or increased funding at all levels.

Benefits of Entomological Collections

- **Rapid identification of costly invasive pests that affect agriculture, forestry, and human and animal health**, which can arrive from anywhere in the world, is only achievable with access to a global reference collection for comparison, as is determination of their potential biological control agents. Invasive insect and mite pests can have tremendous economic impacts (estimated at nearly $33 billion dollars annually in the U.S. due to crop losses and mitigation costs) and profound ecological effects across large parts of the country. Staff at land-grant universities train the next generation of entomologists and provide diagnostic services, yet they face nearly constant pressure to justify the resources and space to maintain these collections, which are vital to performing these functions.

- **Collections are a rich source of research and an essential reference** for all other scientific disciplines, providing a basic vocabulary (taxonomy) and organizational system (classification) to effectively communicate about biology across geopolitical, cultural, and language barriers. Preserved collections represent potential samples for future research using new analytical methods and technologies, allowing us to study them in ways not yet conceived. Increased digitization efforts are making specimens and their associated data from collections globally accessible. Modern collections include tissue and DNA libraries (*e.g.*, Global Genome Initiative, Barcode of Life), providing additional avenues for research but requiring new expertise as well. Living research collections (*e.g.*, the Drosophila Species Stock Center) provide invaluable materials to many other fields such as genetics, medicine, ecology, cellular and developmental biology, physiology and neurobiology.
- **Natural history collections are the only places where the world's natural heritage is preserved** in perpetuity for future generations to study and enjoy, yet these collections find themselves under the same level of threat as the natural resources they seek to document. Specimens in natural history collections represent a vast library of accumulated scientific knowledge about the natural world, organized in a systematic manner that allows for retrieval, study and education.
- **Living arthropod exhibit collections** are critical for educating the public about biodiversity and the ecological importance of arthropods. They also function as an important resource for the conservation and recovery of endangered and threatened species such as the Lord Howe Island Stick insect, brought back from the brink of extinction thanks to rearing efforts at the Melbourne Zoo. These living collections play an important role in raising public awareness, yet the cost and the expertise to maintain them place them in jeopardy.
- **Collections offer a lens into the past, a snapshot of the present, and a means for predicting the future**, particularly with regards to how planetary biodiversity has changed and continues to change in response to global shifts in climate and land use. The size, scope and breadth of entomological collections provide a wealth of data for answering important biological and ecological questions at environmental and evolutionary scales, in addition to serving as one of the most reliable sources of data for recognizing endangered and threatened species and guiding conservation efforts. Entomological collections also serve as repositories for voucher specimens (specimens deposited as a record of what species were involved in any particular study) from all entomological scientific endeavors, enabling confirmation and validation of previous work (reproducibility being one of the basic tenets of science).

Challenges

Despite these many contributions, funding cuts, collections staff reductions, and insufficient training of future taxonomists endanger both collections and the expertise required to care for and use them. Mission-critical scientific infrastructure– particularly in the areas of agriculture, human and veterinary health, conservation,

and biodiversity–rely upon these resources. The unfortunate results of this system-wide attrition of staff are reduced access for research, longer loan processing times, delayed response to inquiries, loss of diagnostic services, and closing of selected parts or entire collections when no staff are available to support them.

Natural history collections are not static cabinets of curiosities but are dynamic centers of research. They continue to grow and evolve as curatorial expertise changes over time, as new questions arise and new methods are developed to address them, and as opportunities to explore previously understudied areas improve our understanding of our planet's biodiversity.

Recommendations

ESA strongly advocates for new or revised policies and increased funding that will result in:

- employment of additional well-trained collections staff to support existing collections
- more opportunities for training in collections management for existing collections staff
- support to improve facilities and infrastructure to maintain collections and capitalize on opportunities for expansion as needs and expertise change
- the development of new analytical methods and technological advances that further our ability to gain new knowledge through the study of specimens housed in collections
- improved funding for resources that result in greater physical and virtual accessibility of collections and the data contained therein
- increased public awareness regarding the importance of collections to science and society as a whole and more opportunities to engage the public through citizen science initiatives

The Entomological Society of America is the largest organization in the world serving the professional and scientific needs of entomologists and people in related disciplines. Founded in 1889, ESA today has more than 7,000 members worldwide affiliated with educational institutions, health agencies, private industry, and government. Members, many of whom utilize collections directly or indirectly but all of whom understand their importance, include researchers, teachers, extension educators, administrators, marketing representatives, research technicians, consultants, students, and hobbyists. For more information, visit http://www.entsoc.org.

For a list of useful references pertaining to the importance of collections, see below.

Ariño, A. 2010. *Approaches to estimating the universe of natural history collections data*. Biodiversity Informatics 7: 81–92.

Drew, J. 2011. The role of natural history institutions and bioinformatics in conservation biology. Conservation Biology 25: 1250–1252.

Duckworth, W. D., H. H. Genoways and C. L. Ros. 1993. *Preserving natural science collections: chronicle of our environmental heritage*. Washington, DC. iii+140 pp.

Federal Interagency Committee on Invasive Terrestrial Animals and Pathogens (ITAP) Systematics Subcommittee. 2008. *Protecting America's economy, environment, health, and security against invasive species requires a strong federal program in systematic biology.*ITAP, Washington, DC. 55 pp.

Feeley, K. J., and M. R. Silman. 2011. Keep collecting: accurate species distribution modelling requires more collections than previously thought. Diversity and Distributions 17: 1132–1140.

Frewin, A., C. Scott-Dupree, and R. Hanner. 2013. *DNA barcoding for plant protection: applications and summary of available data for arthropod pests*. CAB Reviews 8, 018: 1–13.

Hawksworth, D. L. 2004. Biological papers without cited voucher material are so much waste paper. European Science Editing 30: 81–83.

Interagency Working Group on Scientific Collections, National Science and Technology Council, Committee on Science. **2009.** *Scientific collections: mission-critical infrastructure of federal science agencies*.OSTP, Washington, DC. 47 pp.

Kemp, C. 2015. The endangered dead. Nature 518: 292–294.

Krell, F.-T., and Q. Wheeler. 2014. Specimen collection: plan for the future. Science 344: 815–816.

Lister, A. M., and Climate Research Group. 2011. Natural history collections as sources of long-term datasets. Trends in Ecology & Evolution 26: 153–154.

Miller, S. E. 1991. *Biological diversity and the need to nurture systematic collections*. American Entomologist 37: 76.

Miller, S. E. 1991. *Entomological collections in the United States and Canada: current status and growing needs*. American Entomologist 37: 77–84.

Miller, S. E. 2007. *DNA barcoding and the renaissance of taxonomy*. Proceedings of the National Academy of Sciences of the United States of America 104: 4775–4776.

Miller, S. E., J. W. Kress, and C. Samper K. 2004. *Crisis for biodiversity collections*. Science 303: 310.

Natural Sciences Collections Association. 2005. *A matter of life and death – natural science collections: why keep them and why fund them*? NSCA, Yeadon, Leeds, UK. 13 pp.

Pimentel, D., L. Lach, R. Zuniga, and D. Morrison. 2000. *Environmental and economic costs of nonindigenous species in the United States.***BioScience** 50: 53–65.

Pimentel, D., R. Zuniga, and D. Morrison. 2005. *Update on the environmental and economic costs associated with alien-invasive species in the United States*. Ecological Economics 52: 273–288.

Pyke, G. H., and P. R. Ehrlich. 2010. *Biological collections and ecological/environmental research: a review, some observations and a look to the future.*Biological Reviews 85: 247–266.

Rocha, L. A. R., A. Aleixo, G. Allen, F. Almeda, C. C. Baldwin, M. V. L. Barclay, J. M. Bates, A. M. Bauer, F. Benzoni, C. M. Berns, M. L. Berumen, D. C. Blackburn, S. Blum, F. Bolaños, R. C. K. Bowie, R. Britz, R. M. Brown, C. D. Cadena, K. Carpenter, L. M. Ceríaco, P. Chakrabarty, G. Chaves, J. H. Choat, K. D. Clements, B. B. Collette, A. Collins, J. Coyne, J. Cracraft, T. Daniel, M. R. de Carvalho, K. de Queiroz, F. Di Dario, R. Drewes, J. P. Dumbacher, A. Engilis Jr., M. V. Erdmann, W. Eschmeyer, C. R. Feldman, B. L. Fisher, J. Fjeldså, P. W. Fritsch, J. Fuchs, A. Getahun, A. Gill, M. Gomon, T. Gosliner, G. R. Graves, C. E. Griswold, R. Guralnick, K. Hartel, K. M. Helgen, H. Ho, D. T. Iskandar, T. Iwamoto, Z. Jaafar, H. F. James, D. Johnson, D. Kavanaugh, N. Knowlton, E. Lacey, H. K. Larson, P. Last, J. M. Leis, H. Lessios, J. Liebherr, M. Lowman, D. L. Mahler, V. Mamonekene, K. Matsuura, G. C. Mayer, H. Mays Jr., J. McCosker, R. W. McDiarmid, J. McGuire, M. J. Miller, R. Mooi, R. D. Mooi, C. Moritz, P. Myers, M. W. Nachman, R. A. Nussbaum, D. Ó Foighil, L. R. Parenti, J. F. Parham, E. Paul, G. Paulay, J. Pérez-Emán, A. Pérez-Matus, S. Poe, J. Pogonoski, D. L. Rabosky, J. E. Randall, J. D. Reimer, D. R. Robertson, M.-O. Rödel, M. T. Rodrigues, P. Roopnarine, L. Rüber, M. J. Ryan, F. Sheldon, G. Shinohara, A. Short, W. B. Simison, W. F. Smith-Vaniz, V. G. Springer, M. Stiassny, J. G. Tello, C. W. Thompson, T. Trnski, P. Tucker, T. Valqui, M. Vecchione, E. Verheyen, P. C. Wainwright, T. A. Wheeler, W. T. White, K. Will, J. T. Williams, G. Williams, E. O. Wilson, K. Winker,R. Winterbottom, and C. C. Witt. 2014. Specimen collections: an essential tool. Nature 344: 814–815.

Suarez, A. V., and N. D. Tsutsui. 2004. The value of museum collections for research and society. BioScience 54: 66–74.

Tewksbury, J. J., J. G. T. Anderson, J. D. Bakker, T. J. Billo, P. W. Dunwiddie, M. J. Groom, S. E. Hampton, S. G. Herman, D. J. Levey, N. J. Machnicki, C. Martínez del Rio, M. E. Power, K. Rowell, A. K. Salomon, L. Stacey, S. C. Trombulak, and T. A. Wheeler. 2014. Natural history's place in science and society. BioScience 64: 300–310.

Warren, A.D. 2015. Why we still collect butterflies. The Conversation. https://theconversation.com/why-we-still-collect-butterflies-41485

Winker, K. 2004. Natural history museums in a postbiodiversity era. BioScience 54: 455–459.