

OPINION

Valuing collections

This year brought dismal news about the world's birds: They are vanishing at an alarming rate. Across 25 European countries, about 420 million fewer birds are present today than in 1980, a 20% decrease, especially in the 36 most common species. In North America, *The State of the Birds Report 2014* indicates that over the past 40 years, the numbers of individuals across 33 species are also down by hundreds of millions. Such assessments highlight the urgency of determining the precise causes of these declines. The knowledge gleaned from the Avian Phylogenomics Project, coupled with ecological and population analyses, should provide new insights into the factors that influence bird declines and extinctions. As the project progresses over the next few years, over 60% of tissue samples for the avian analyses will be derived from archived museum collections. In this era of deteriorating natural environments, a pressing challenge is to continue to build scientific collections for future needs.

Museum collections, and the species they represent, provide windows into the past, inform about the present, and help predict the future of natural habitats and human-altered environments. They are the common language of the biological sciences. An antiquated view of collections suggests drawers of bird skins, empty shells, and dried plants. However, current collections also include living specimens, spirit-preserved samples, deep-frozen tissues, and DNA. These irreplaceable biomaterials are invaluable representatives of Earth's biodiversity, and together with their associated metadata are archived *ex situ* for long-term documentation, public education and exhibition, and scientific and applied research. Although the exact number of collections maintained in museums, botanic gardens, and universities is unknown, estimates as high as three billion specimens suggest the magnitude of this storehouse of information about the natural world.

Many scientists continue to use collections to discover, describe, and document plants and animals with time-proven methods. At the same time, the application of new and multiple technologies to study specimens is blossom-

ing. For example, much of our current understanding of some recently extinct species, such as the Tasmanian tiger, the Caribbean monk seal, and the passenger pigeon, has directly resulted from genomic information extracted from museum collections. And combining DNA-, amino acid- and isotope-based analyses of a few grams of bone from a historical specimen of an endangered Pacific seabird, the Hawaiian petrel, has illuminated aspects of the bird's diet, past population demographics, food chain dynamics, and the deleterious impacts of industrial fishing on this oceanic predator. Museums are becoming an unparalleled resource of tissue samples for large-scale genomic studies of animals and plants.

Yet contributions to genomic studies are but one use of museum collections. Extinctions due to human impacts are also readily studied through historical records preserved in scientific collections. These records reveal former patterns of geographic distributions and population abundances of species that today are threatened or extinct. Museum collections equally contribute to the discovery of previously unknown species, such as the olinguito, a carnivorous mammal from South America.

Most museum specimens were not collected for the purposes for which they are now used. Innovation in technologies will continue to reveal new information previously unanticipated in scientific specimens.

Therefore, the most pressing challenge is to build collections for future needs that maximize access and benefit-sharing for all. Collections must be sustained for the long term, which will require increased funding for their physical and scientific curation. A formidable task that has only just begun is the computerized inventory and digitization of the wealth of information that collections represent. At present, most of these data are not accessible electronically or online.

The worldwide decline of birds is just one part of a large and grim picture; the number of individuals of all wild animals on Earth has decreased by 50% since the 1970s. This drastic decline underscores the vital inherent value of museum collections today, tomorrow, and into the future.

— W. John Kress



W. John Kress is the Interim Under Secretary for Science at the Smithsonian Institution and Distinguished Scientist and Curator of Botany at the National Museum of Natural History, Smithsonian Institution, Washington, DC. E-mail: kressj@si.edu



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