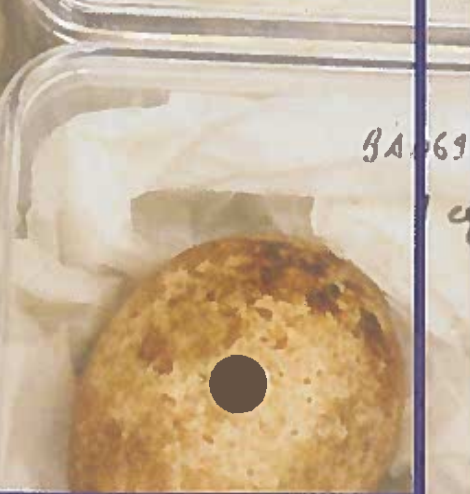
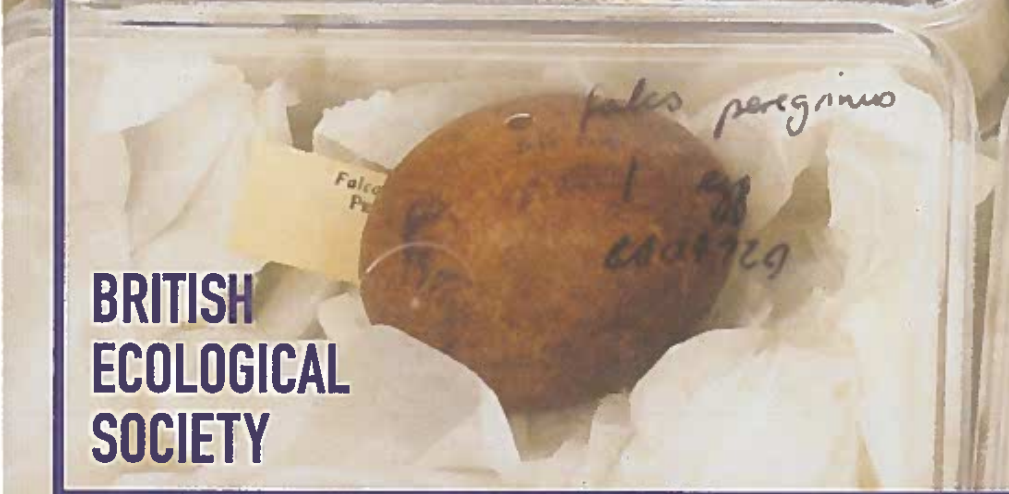


# THE BULLETIN



BRITISH  
ECOLOGICAL  
SOCIETY

FEATURE

# HOW CAN MUSEUM COLLECTIONS BETTER SUPPORT ECOLOGICAL RESEARCH AND NATURE CONSERVATION?



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UK museums hold 140 million natural history specimens – a vast and underused source of information for ecologists. Henry McGhie from Manchester Museum explores how ecologists and museums can work together to tackle some of the biggest research questions around biodiversity and climate change.

UK museums contain roughly 140 million natural history specimens, including mammal and bird study skins, taxidermy mounts, bones, pinned insects, dried molluscs and other invertebrates, dried plants, lichens and fungi, specimens on microscope slides and preserved in alcohol/formalin, fossils, rocks and minerals. There are roughly 80 million specimens in the Natural History Museum (London), and 60 million in other museums. Collections have been built up since the 19<sup>th</sup> century. Large museums have encyclopaedic, global collections. Regional museums often contain the best collections for their region, and even relatively small museums can be home to very important collections.

In addition to these, the Hunterian Museum (Royal College of Surgeons, London), Lapworth Museum of Geology (University of Birmingham), Leeds City Museums and Galleries, Sunderland Museum and Galleries, Museum: Hancock (Newcastle upon Tyne), Yorkshire Museum (York), University of Aberdeen (zoology,

plants and geology), Kelvingrove Museum and Art Gallery (Glasgow), Hunterian Museum (University of Glasgow), Perth Museum and Art Gallery, Elgin Museum, and Bell Pettigrew Museum (University of St. Andrews) are recognised for their national importance by the UK and Scottish governments. A number of English university museums receive funding from Research England as a research infrastructure, and a similar scheme runs in Scotland (run by the Scottish Funding Council).

Museum collections are often associated with taxonomy, and they certainly support taxonomic research; there is plenty of work to do, with an estimated 86% of land species and 91% of marine species awaiting description (Tittensor *et al.* 2011). However, museum collections support the exploration of a much wider range of ecological and environmental topics. Specimen labels provide basic information on what species occur where, or at least where they once occurred. Even today, historical collections are a basic source of

information on the occurrence of species in remote areas, although rapid environmental change may mean that they reveal where species still occur. Specimens enable former assessments of distribution and identification to be reassessed, notably in light of taxonomic changes. Museum specimens are a major contributor to IUCN Red List assessments, and are an essential tool for work on the Convention on Biological Diversity, and for national and local biodiversity assessments. Collections reveal environmental change, the most famous example probably being Derek Ratcliffe's work linking the decline in birds of prey in the UK in the mid-20<sup>th</sup> century to egg-shell thinning as a result of DDT poisoning. Collections of eggs, plants and insects reveal changes in phenology. For example, Brooks *et al.* 2014 found strong relationships between the flying time of British butterflies and spring temperature, based on specimen data from museum collections. Specimens are sampled for DNA to explore relationships within and between



Encyclopaedic collections built up over many years mean collections are 4 dimensional, with a time dimension.

UK museums with more than a million natural sciences specimens

|   | Number of specimens |
|---|---------------------|
| Natural History Museum                                  | 80 million          |
| National Museums of Scotland                            | 10 million          |
| Royal Botanic Gardens, Kew                              | 8.5 million         |
| Oxford University Museum of Natural History             | 5.65 million        |
| Manchester Museum, University of Manchester             | 4.5 million         |
| British Geological Survey                               | 4 million           |
| Royal Botanic Garden, Edinburgh                         | 3 million           |
| World Museum Liverpool                                  | 1.6 million         |
| National Museum of Wales                                | 1.3 million         |
| Cambridge University Museum of Zoology                  | 2.75 million        |
| Bristol Museum  | 1.1 million         |
| Cambridge University, Sedgwick Museum of Earth Sciences | 1 million           |
| Norwich Castle Museum and Art Gallery                   | 1 million           |

species, informing decisions on reintroductions. DNA sampling also helps explore population dynamics, the timing of bottlenecks, and changes in gene frequency over time. Changes in levels of environmental pollutants over time can be revealed from samples of animal and plant tissues (such as mercury in the feathers of seabirds). Analysis of stable isotopes reveals a whole range of details on diet and trophic levels, and even migration of animals.

The ongoing usefulness of collections is threatened for four main reasons. Firstly, collections are not as visible

or accessible as they could be: faced with enormous numbers of specimens, the task of digitising and networking collections is monumental. Secondly, museum funding cuts mean that there are less natural-history-trained curators in museums than there used to be. Thirdly, there is relatively little contact between researchers and museums, or a strategic relationship between museum collections and research agendas. Fourthly, collections need to continue to be developed to ensure that time series studies can be made, and that specimens are preserved and information curated so that they are useful.

It is important that collections continue to be useful and used by researchers, policy makers, and those working directly with site and species conservation. Just as environmental science has been transforming rapidly, there should be new ways of working that draw more effectively on museum collections. Also, in a time of reduced resources, it is important to understand how collections can support global biodiversity in strategic ways.

A project is underway, funded by the BES, that seeks to develop better links and better understanding between ecologists and other environmental researchers, and museum workers, of the current and unrealized potential of museum collections. This is framed around the '100 questions of importance for the conservation of global biodiversity' (Sutherland et al. 2009). Online surveys are completed by experts (researchers, practitioners, policy workers) and, separately, by museum workers (curators, collections managers, etc.), on their perceptions of the current and potential usefulness of UK museum collections in addressing 12 research areas: ecosystem function and services, impact of climate change on biodiversity and ecosystems, impacts of technological change on biodiversity, protected areas and biodiversity, ecosystem management and restoration, terrestrial ecosystems, marine ecosystems, freshwater ecosystems, species management, nature conservation organizational systems and processes, impacts of societal change on biodiversity, and impacts of nature conservation interventions. This helps identify both the research potential and any perception gaps between experts and museum workers, and helps build a better, shared understanding of the potential, and limitations, of museum collections. Some generic questions help identify how and where researchers, practitioners and policy workers would discover information on museum collections.

The project will make recommendations to the museum sector, BES, funders and research agencies/councils. Already, the surveys show that researchers, policy workers, site and species managers can see tremendous potential for museum collections to support the conservation of biological diversity.



The timing of Corncrake population collapse was explored by studying the proportion of adult and immature Corncrake specimens collected over time.



Museum collections of eggshells played an important role in identifying the environmental impact of DDT in the 20th century.

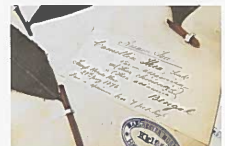
Responses have been received from people working within some of the UK statutory nature conservation agencies, Kew, Royal Botanic Gardens Edinburgh, Institute of Zoology, Centre for Ecology and Hydrology, many universities, environmental records centres and international agencies including IUCN. Responses have come from many of the national focal points for the various groups working in support of the Convention on Biological Diversity. The project is looking to get many more responses (this is you!), and will be open until January 2019.

People working in ecological/environmental/nature conservation research, policy and wildlife/habitat/environmental management are invited to complete the survey at this link: <https://www.surveymonkey.co.uk/r/552R3GV>

People working in museum curation, management and policy are invited to complete a similar (but not identical) survey at this link: <https://www.surveymonkey.co.uk/r/N3N8QG8>.

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Specimen labels are an important source of data, as on this label from a herbarium sheet of Assam Tea, from 1876.

INTERESTED IN EXPLORING UK NATURAL SCIENCES COLLECTIONS?

Find natural sciences collections in UK museums [natsca.org/NHNearYou](https://natsca.org/NHNearYou)  
 Search collections in UK museums [natsca.org](https://natsca.org)