

A Matter of Life and Death

Natural science collections: why keep them and why fund them?



NatSCA

Natural Sciences Collections Association

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1. Introduction

When people think of natural science collections, images of dark rows of dusty taxidermy and ‘things’ in murky spirit often spring to mind. With such a reputation, governing bodies may find themselves justifying why these collections need funding at all.

This document aims to assist museum governing bodies to make informed decisions by explaining the true costs and benefits of owning and resourcing a natural science collection.

The UK has some of the largest and most important natural science collections in the world including around 20 million specimens held outside of the nationally supported institutions. It is hoped that organisations lucky enough to care for some of these view them as a source of pride rather than with indifference or even hostility.

2. We have all these dried plants and stuffed animals – why should we keep them?

Natural science collections play a substantial role in:

- understanding biodiversity
- supporting nature conservation
- furthering education
- serving the community

Specimens held in biological collections form a physical inventory of biodiversity. Biological specimens are kept, in preference to data and images alone, for the physical information they contain. As the science of DNA, proteins and other biological information grows ever more advanced, the range and usefulness of this information is constantly improving.

The Natural Environment Research Council’s report on Evolution and Biodiversity states:

“The UK has a global responsibility with respect to its national, university and local collections of material in museums, herbaria and botanic gardens, which are among the greatest in the world and are suffering from lack of maintenance and research because of insufficient funds.”

Developments in information technology are now allowing the potentially encyclopaedic nature of these collections to be realised.

Classifying Life

Systematics and taxonomy, the science of naming and classifying species, underpin all other aspects of biology. A House of Lords Select Committee report states that systematic biology research is essential to biodiversity and its conservation and acknowledges that 'collections are fundamental to conducting useful systematics'.

- Although systematic biology research may not take place in all museums, the specimens themselves are still involved through loans to, and visits from, other institutions.

Type specimens

Around 1.5 million species have been described so far. The name and description of every one of these is based on a *type specimen* stored in a biological collection somewhere in the world. Type specimens are unique and highly scientifically valuable.

- Whilst major natural science museums have significant type collections, it is common to find these important specimens in regional museums too.

Extinct species

Biological collections house extinct species. These specimens have become the only source of physical information for a species. For example, the DNA analysis of museum-stored Quagga specimens has led to an attempt to re-create this extinct zebra by selective breeding from Plains Zebras.

- Many regional collections hold examples of species that are extinct in Britain. This local data has contributed to the success of reintroduction schemes from abroad.

Guides and keys

Field guides and keys are certainly useful in identifying species but it is important to remember that they are always based, in part, on biological collections. Furthermore, for many parts of the world, and for many living groups, no such published aids exist. Even familiar groups are still under review; for example The Botanical Society of the British Isles' *Handbook of Dandelions of Great Britain* lists 103 more species than the previous key.

- Field guides rely heavily on local data, found in abundance in regional collections, to produce species distribution maps.

Redefining species

Historic collections are now being investigated in ways never envisaged by their collectors. New techniques, like electron microscopy, thin layer chromatography, DNA sampling and so on, are vastly increasing our understanding of biodiversity and providing new opportunities for its conservation.

New species are constantly being discovered both in this country and around the world. It is estimated that we share this planet with between 10 million and 100 million other species, of which only 1.5 million have been described. The only way to determine whether a species is new or not is to compare it with specimens of similar species already named, described and housed in biological collections.

- The Bottle-nosed Dolphin was divided into two species after researchers examined almost 300 skulls housed in collections across the country. Also, museum bird skins have been used to identify a rare species of petrel, resulting in it receiving special protection.

Data

Associated information greatly enhances the usefulness of a specimen. Data on the place and date a specimen was collected greatly enhances its uniqueness and value.

- Every natural science collection in the country has its own unique set of data - irreplaceable and of vital importance to understanding and aiding biodiversity in Britain and the world.

Information on the place of collection allows the use of specimens to investigate species distribution. Written records can also assist with this but should a record be disputed there is no way of proving the validity of the record in question without a physical voucher specimen.

The date of collection of specimens is also important as it allows investigation of changes, whether in form, distribution or habitat composition. While it is possible to find out what currently lives where, it is impossible to determine whether this has changed without reference to historical biological collections. For example after nuclear testing in the Pacific, there was concern about radioactive contamination of the resident plants and animals. Without specimens collected before the tests there would have been nothing to measure the radiation levels against, no guessing at what 'normal' levels were.

- Provincial collections, with their hoard of rich local data, carry indisputable climate, pollution, species distribution and biodiversity records for an area.

Close relations

Understanding how different species are related to one another allows us to classify the living world. Such knowledge allows us to make better and more effective use of nature. For example the antiviral drug castanospermine was found in small quantities in the Morton Bay Chestnut. Taxonomists at Kew found this Australian plant to be closely related to an Amazonian plant. This turned out to have both greater quantities of the drug and less toxic forms of it.

Supporting Other Research

Biological collections support a whole range of disciplines and professions for which the end product is valued but the role of the collections in it is often unnoticed. A US publication. 'Floristics for the 21st Century' listed 46 different professions that might use taxonomic information.

Agriculture

The use of biological collections to study relatives of crop species can assist breeding programmes to improve and modify yields. For example, the discovery of seeds of a new species of wild tomato in museum collections led to a new cultivated hybrid with an increased soluble solid content – estimated to be worth an extra US\$8 million per year.

Disease and pest resistance have also been improved. For example, wild relatives of crop plants such as wheat, rice and potatoes possess valuable genetic characters that give resistance to diseases, pests or environmental stresses.

Biological collections can be used to provide early and accurate identifications of often quite indistinguishable pest species. They can also help in the search for natural predator species to help reduce the problem. For example, a mealy-bug outbreak in Zaire costing \$1.4 billion per year was controlled when taxonomists discovered the effective parasite in South America and supervised its introduction to Africa. Other information associated with biological collections on pest life cycles, larval growth patterns, mimicry, polymorphism and migration can be used to further control pest species. For example, museum collections have been used to locate locust outbreak sites and track traditional migratory patterns.

Biological collections can be used to predict the viability of growing crops in new areas. Location details on labels can be correlated with environmental data such as rainfall, temperature, altitude, soil type etc.

Health

Environmental health officers use biological collections to identify the often mangled, cooked or partially digested animal remains found in food, from slugs in milk to bones from a suspect take-away. The collections are also used to quickly identify pest infestation, either by direct reference or through the training of professionals based on them.

Medicine

Half the world's medical products are obtained directly from plants yet only a small proportion of species have been screened for pharmaceutically useful compounds. Screening of only 150 species of leguminous plants at Kew revealed a new drug with potential HIV application. Studying the chemistry of plants kept in biological collections can provide clues on what plants to look for on subsequent field expeditions, thus reducing costs and increasing efficiency. Biological collections are also of use in determining the identity of plants found on such expeditions.

In addition to modern discoveries, label data on more ancient uses of plants could reveal medicinal properties. For example, a survey of the Harvard herbarium revealed that many labels contain information about the medicinal use of plants by indigenous peoples.

Accurate identification, using biological collections, has greatly assisted the understanding of many diseases such as bilharzia, bubonic plague, schistosomiasis, malaria and river blindness.

Biological collections also provide rapid identification for patients who have been bitten by animals thought to be venomous or eaten plants or fungi suspected of being poisonous.

Crime

Biological collection can assist in the detection of crime. For example, collections have been used for the identification of plant fragments, seeds, pollen grains and animal hair etc. linking suspects to the scene of the crime. Identifying fly maggots present, and relating this to the biological sequence of decomposition, can approximate the time of death of a partially decomposed body.

Archaeology

Biological collections play an important role in archaeological investigations by means of comparison, identification and the dating of bones, bone fragments, seed and pollen grains. Many of these finds are subsequently used for museum displays.

Ethnography

Ethnologists require bits and pieces of feather, fur, skin, bone, shell, botanical material etc. found as parts of artefacts to be identified. This often requires reference to biological collections. As above, many of these artefacts are used as display items in museums.

Timber

Curators of decorative arts, antiquities and maritime collections often require wood employed in these objects to be identified through reference to timber collections. Once again many of these artefacts are used as display items in museums.

Social history

Biological collections can also provide information on social history. They have been described as being 'like a series of diary dates with the dimensional pieces of the living world attached.'

Copying nature

Both student and professional designers and engineers have used nature as inspiration for their design. For example, a top yacht designer spent much time study tuna fish specimens as an aid to designed faster yachts. Research

in to the reduction of drag on airlines has involved the study of shark skins held in biological collections.

Future research

An argument based on the possibility of finding a use for something at some point in the future would generally be regarded as a weak one. However, in the case of biological collections (as illustrated here), there have been so many cases of specimens being used for purposes vastly different to the purposes for which they were originally collected, that serious consideration should be given to this.

Education

Natural science collections play an integral role in the delivery of any museum schools service either through visits to museums and collections or by means of a school loan service. Biological collections are of direct relevance to all Life Science Key Stages of the National Curriculum.

Natural science collections also represent an important resource for students of higher education through the provision of training in identification, taxonomy and classification and of access to reference material for a wide range of research and project work.

They offer an excellent resource for supporting evening classes and other adult learning opportunities. Many museums have close links with local university and/or the Local Education Authority for this purpose.

Local Identity

Museums play an important role in establishing local identity. The wealth of material contained within biological collections can have a major role to play in this. While locally collected material has an obvious role to play here, material collected from afar can also be of use as the collectors were often of local origin thus allowing the past adventures of local people to be told.

3. Why should we collect more?

‘Further enlargement of collections is necessary not only to continue the documentation of biodiversity - as yet far from complete – but also to permit the study of biological response to changes in global climate.’

The Natural Environment Research Council
Report on Evolution and Biodiversity

Nature conservation

The massive amount of information held by biological collections is of enormous importance to the environment. Surveys and distribution maps of

biodiversity are of fundamental importance to developing nature conservation strategies. Biological collections assist this process by providing an identification resource and supplying information on historical distributions. Through them a better idea of what changes are taking place and what needs to be done can be formed.

- A report by English Nature on nature conservation states 'provincial museums' and universities' collections also continue to be an important source of reference, supporting surveys and other research'.

Habitat protection

Biological data is of vital importance for processing planning applications and environmental impact assessments. Claims made in associated reports are open to questions unless they can be verified by voucher specimens held in collections.

Successful habitat re-creation and regeneration programmes rely on accurate data from biological collections on what is, what was and what should be in any particular habitat.

Successful species recovery programmes need accurate information on habitat requirement. Biological collections play an important role in formulating these.

Pollution

Pollution represents a major problem for wildlife. Biological collections can be used to monitor levels of pollution either by correlating data from indicator species or through chemical analysis of specimens collected over time. For example lichens, well known indicators of atmospheric pollution, can provide information on changes over time, thus helping towards developing anti-pollution strategies. Similarly, research at Manchester Museums has shown that the shell of the common winkle can be used to establish an accurate measure of critical levels of radiation in coastal waters. Dried foliage samples stored in air-tight metal containers were recently analysed to study the decline in the concentrations of PCBs in the air of rural England since the chemical's use was restricted in the 1970s.

- Regional collections house data on local changes in pollutant level. This data is not necessarily available from larger collections more concerned with patterns in national or world pollution.

Species decline

Declines in species populations as monitored in the field, often require biological collections for explanations. For example the cause of a fall in certain bird populations was found to be thinning eggshells. After correlation with other information using the precise date and location data associated with the specimens, the cause was found to be DDT pesticides, DDT has subsequently been banned.

The potential effects of global warming on both individual species and on habitats can be predicted by monitoring past changes as portrayed in natural science collections.

Wildlife law

Natural science collections provide support for the enforcement of many wildlife laws. For example, many museums provide identification services for material seized by HM Customs and Excise staff suspected to be in breach of the Convention on International Trade in Endangered Species (CITES) while the successful prosecution of badger baiters has been achieved through the identification of hairs found on suspects or their equipment.

Biological records

Many biological collections are linked to, and provide support for biological recording schemes and records centres.

- Amateur naturalists play an important role in monitoring, recording and conserving nature. Biological collections and their curators can provide vital support for such work.

Natural variation

Individuals within a species are not identical. Accurate classification requires an understanding of how much variation occurs within each species. Such study obviously requires access to large numbers of specimens of the same species.

- Whilst the selective collection of specimens still continues today, it is important to note that specimens already contained within national and regional biological collections reduce the pressures for wide-scale collecting. This is particularly important for scarce and endangered species.

Guide books

Authors of the many books and guides on natural history often consult biological collections during their preparatory research. While the value of such books in promoting public awareness and understanding of our natural world is generally acknowledged, the role of biological collections in their preparation is usually overlooked.

A note on sourcing specimens and Victorian collecting.

Contrary to popular belief, museums today do not kill birds and mammals for their collections. Specimens are derived from animals found dead as a result of cold weather, being caught by cats, hit by cars etc. For example, Liverpool Museums received a large number of birds as a result of an oil spill in the River Mersey. The company responsible paid the Museum to identify all the dead birds to assess the damage. Once cleaned the birds were added to the

collection, researching them could benefit their living counterparts in the event of another oil spill.

It is true that many mammal and bird specimens in museums, dating back to Victorian times, were shot, often as hunting trophies. Housing such specimens does not mean that museums condone this method of collection. We cannot reverse the past but we can make good use of them for the benefit of wildlife.

4. What can we do with a natural science collection?

Display

Exhibitions and display based on biological collections represent some of the most popular museum attractions. While it is possible to buy in travelling exhibitions, only local collections can provide the basis of displays and exhibits that interpret the local environment and its importance.

Events

Biological collections can make an enormous contribution to the running of a popular and successful events programme. Furthermore they provide the basis for tapping into the massive public popularity of natural science by running events based on topical natural history issues and campaigns.

Education

Museum exhibitions, events and lectures based on biological collections contribute to a greater public understanding and appreciation of nature, both local and world-wide, and the need to conserve it.

The importance of biological collections in contributing to the success of a museum does not just benefit the local community directly but also indirectly by helping to boost tourism and thus the local economy.

Today, museums have to compete with an ever-wider range of public attractions. It is worth remembering that most of these do not have the depth of resource represented by the museum's collections. Natural science collections often represent the largest component of these collections which, when used imaginatively, hold the key to providing a unique attraction.

Artists

Biological collections provide a resource for artists and designers students and professionals alike, studying and incorporating natural designs into their work.

Study

Biological collections act as a focus for the study of local natural history. Many museums have very active local natural history societies based with them. Benefits from this can include the addition of well-identified specimens to the collection and the dispelling of the myth that museums and their collections have nothing to do with real nature conservation.

Enquiries

Biology curators receive thousand of enquiries from local and national conservationists, researchers, planners, environmental health officers, customs officers and so on every year. Identifications are often only confirmed by direct comparison with named museum specimens.

- The development of a plot of land in your area could rest entirely on the accurate identification of, for example, a rare flower or beetle. A local biology collection would not only have reference specimens but may well contain historical examples of the species from the plot of land in question.

...but not without a natural science curator...

A natural science collection is reaching only half of its potential without a curator. Some core functions just aren't possible without the expertise of a natural scientist. As well as using the collection, a curator would, of course, be able to provide appropriate collection care to ensure its long-term future.

5. Can't we leave all this to the larger institutions?

The big picture

All biological collections represent jigsaw pieces in a global biodiversity database and, therefore, have the potential to be of value internationally as well as locally. In this way, all of the previous sections can be related to even the smallest collection.

Promoting collections, through documentation, catalogue publishing and the running of a loans programme, can lead to unknown and valuable results. Ongoing developments in information technology are vastly increasing the potential accessibility of local and regional collections.

Local treasures

Many local collections contain very important specimens and collections, sometimes unknowingly. There are many examples of these coming to light after decades in store. For example, a dusty old collection of plants at Liverpool Museum was nearly thrown away due to its seemingly poor condition. Fortunately, it was kept and later turned out to be the herbarium of J.F. Royle, an important and pioneering collector of plants from northern India, rich in type material and missing for over a hundred years. This collection now represents Liverpool Museum's single most important herbarium.

Local wildlife

Biological collections have a regional and local scientific value through their interpretation of the local environment, its protection and improvement. The importance of this role should not be overshadowed by the global importance of the collections of larger institutions.

6. What can we do if we have to dispose of our natural science collection?

If, despite the overwhelming case in favour of keeping your natural science collection, you are being asked to dispose of it then please contact NatSCA.

- NatSCA is committed to safeguarding natural science collections for present and future use by both the local and wider communities they serve. The Association can provide expert advice and help to any organisation in the process of considering the future of its natural science collection.
- NatSCA fully acknowledges the constraints on resources faced by museum governing bodies and seeks only to find the best solution for the collections and museum alike. It is important to ensure however, that the long-term well being of the collections is not jeopardised by short-term financial situations.
- NatSCA is not opposed to change or new thinking and positively welcomes opportunities for greater use of and access to natural science collections. However, proposed changes must not adversely effect the long-term well being of the collections.

If the worst comes to the worst then, as the national body for natural science collections, NatSCA will be able to draw on expertise from across the country to advise on how best to re-home an orphaned collection.

7. What are other museums doing?

The most successful of these use their natural science collections as a lynch pin for environmental, geological and biological protection, research and education across their organisation.

8. Where can I go for more advice?

Putting 'Bloody Mice' to Good Use (Museums Journal) and *The Cultural Impact of Natural Science Collections* (The Value and Valuation of Natural Science Collections Proceedings) are highly recommended reading.

NatSCA, with its unrivalled wealth of knowledge and expertise, can assist any museum governing body with natural science collection issues: from advising decision makers to collection auditing to guidance on collection care. NatSCA is always pleased to offer advice on all aspects of the care, access and use of natural science collections.

In order to be of the greatest assistance, NatSCA asks governing bodies proposing changes to:

- provide NatSCA with details of the proposals and of plans for their future care and usage

- allow NatSCA to submit comments to any relevant body, committee or working party regarding such plans and proposals: and
- keep NatSCA informed as to the ongoing situation.

9. What is NatSCA?

NatSCA was formed in 2002 with the amalgamation of the Biological Curators Group and the Natural Sciences Conservation Group. The membership is made up mainly of natural history curators and conservators with a nationally widespread variety of institutional members.

It exists to promote natural sciences collections and their appropriate use and care, and its aims include acting as an advocate, providing training and promoting best practice within the network of its colleagues and affiliated institutions. These are pursued through three principal areas of activity: meetings & events, publications and campaigns.

It is *the* national forum for natural history collection discussion and expertise. 'NatSCA News' is the Association's regular publication (for more information visit www.natsca.org).

NatSCA holds the view that biological collections, when properly maintained, represent a rich, unique and educational resource distinguishing museums from other public attractions. They offer great benefits to the museum or service they reside with. Their continued well being, therefore, represents a common goal for governing bodies and NatSCA alike.

Please contact Clare Stringer, Collections at Risk Committee Member for NatSCA, Leeds Museums Resource Centre, Moorfield Road, Yeadon, Leeds, LS19 7BN (0113 214 6526, clare.stringer@leeds.gov.uk) or Nick Gordon, Chair, NatSCA, New Walk Museum and Art Gallery, 53 New Walk, Leicester, LE1 7EA for further information.