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NatSCA
Natural Sciences Collections Association

The Natural Sciences Collections Association

The Natural Sciences Collections Association (NatSCA) is a UK-based membership organisation and charity (number 1098156, registered in England and Wales), which is run by a committee of volunteers elected from the membership.

NatSCA's mission is to promote and support natural science collections, the institutions that house them, and the people that work with them, in order to improve collections care, understanding, accessibility, and enjoyment for all.

Further information about NatSCA can be found online at: http://www.natsca.org/.

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Submitting to the Journal of Natural Science Collections

Aims and scope

The *Journal of Natural Science Collections* is published once a year, usually in December. It is a place for those working with these collections to share projects and ways of working that will benefit the museum community. The journal represents all areas of work with natural science collections, and includes articles about best practice and latest research across disciplines, including conservation, curatorial methods, learning, exhibitions, and outreach. Articles in the Journal should be relevant and accessible to all of our diverse membership. All submissions are peer reviewed, resulting in high quality articles.

Preparing and submitting your manuscript

Before preparing your manuscript, please thoroughly read the guidelines for authors available on our website (http://www.natsca.org/guidelines-for-authors). Articles should not normally exceed 8,000 words.

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Front cover image: Diatom slides from the Thomas Comber collection, held at the Natural History Museum, London (NHM). Image © The Natural History Museum.

Editorial

Welcome to the fourth volume of the Journal of Natural Science Collections, and my first as Editor. I hope that you find the articles interesting, useful, and inspiring.

This year we have two NatSCA Conference articles, from the 2015 and 2016 conferences. Radley covers audience engagement through the use of museum mascots on social media, and Sutcliffe gives an account of the long and fruitful relationship between Glasgow Museums and the local Natural History societies. The themes of engagement and collaboration with non-specialists are combined in an article describing a project at the Natural History Museum, London (NHM), that involves public participation in curatorial work (Yesilyurt et al.).

This volume also features several papers focused on particular collections: An international contribution describes the Colección Nacional de Mamíferos held at the Insitituto de Biologia in Mexico City (Cervantes et al.). The article highlights what a wonderful resource this collection is, and adds to the literature on the importance of natural science collections. Allnatt provides an account of the rediscovery of part of Henry Walter Bates' personal Lepidoptera collection within Oxford University Museum of Natural History. This article illustrates the value of retaining information with specimens, and the rewards of diligent research! Baker discusses the herbarium collection of James Needham, and its distribution among various UK institutions. Archive documents help to bring together information on this fascinating collector.

Conservation also features in this volume, with an article on food management for Integrated Pest Management (IPM) within museums and historic houses (Ryder). This paper includes clear information and practical advice.

I would like to thank all of the authors for their contributions, and the anonymous reviewers who generously volunteered their time and expertise to ensure that the Journal maintains a high standard. I would also like to thank the NatSCA Committee, particularly former Editor Jan Freedman, and volunteers David Notton and Justine Aw, for their support in preparing this volume.

All articles in this volume are available online as full-colour PDFs (http://www.natsca.org/journal). Access is free to NatSCA members, with the use of a password. If you need assistance in gaining access, please contact Membership Secretary Maggie Reilly (membership@natsca.org). Previous volumes are also available on our website, and are free to download for all users.

Rachel Jennings (Editor)
January 2017

NatSCA Conference and AGM 2017

Thursday, April 20, 2017 - 10:00 to Friday, April 21, 2017 - 17:00
University Museum of Zoology, Cambridge

Evolving Ideas: provocative new ways of working with collections

This conference aims to generate real food for thought for anyone interested in enhancing how museums with natural sciences collections operate. We want to provoke, explore and inspire new ways of working.

The range of possible topics is broad, but all sessions will focus on findings that will be useful for other delegates to hear, or provocations for changing practice.

Conference booking will open in February 2017. We look forward to seeing you there!

For more details see our website (http://www.natsca.org/conference2017).

View from the Chair

2016 has been a year of surprises. Significant upheavals in global politics will have repercussions for natural sciences collections that are yet to be fully realised or appreciated. The legislative frameworks within which we work will doubtless be affected, bringing a need for us to be aware of our changing obligations, but also providing an opportunity to feed into the process of legislative change. Elements of this emerged at the Linnean Society Plenary in September, where Jason Reeves of the Chartered Institute of Ecology and Environmental Management presented on the implications of Brexit for ecology professionals. At the same meeting, I made a plea for better communication and knowledge-sharing within the sector when it comes to unpicking and clarifying the requirements for collections set by the Nagoya Protocol, which entered into force on 22nd of May this year in the UK[1].

The take-home message about Nagoya is to not worry about it too much unless you need to acquire material collected after October 2014, and to exercise appropriate due diligence and documentation for your acquisitions and collecting - which you should be doing anyway. While on the topic of the law, there was some progress on the delicate issue of egg collections in January of 2016, following consultation on the subject, to which NatSCA contributed. The outcome is that it is no longer an offence to hold wild bird eggs if they can be shown to have been collected prior to 1981, rather than prior to 1954[2]. This will be a relief to all those responsible for collections who were given data-poor eggs in the late 1950s through to the end of the 1970s, and who have been inadvertently breaking the law for the past 12 years. I would like to acknowledge the efforts of Douglas Russell in guiding the sector and coordinating the push for the change in legislation to get this positive outcome.

With the law at the forefront of our minds, our training this year has had a somewhat legal slant. In January we worked with colleagues in the Society for Museum Archaeology (SMA) and Museum Ethnographers Group (MEG) to deliver a Curating Human Remains in the UK seminar, and we collaborated with the South West Area of Natural Science (SWANS) Collections to deliver a joint Natural Science and the Law seminar in June. We have also been working particularly closely with the Geological Curators Group (GCG) to develop a joint project to create a mechanism for skills sharing using videos and a wiki. So far we have not been able to secure funding to aid in the delivery of this, but the process is ongoing and over £50k of waived location fees and staff time have been offered by museums around the UK to support the project.

We have noticed that Arts Council England funding has become less accessible for Subject Specialist Networks (SSNs) due to the change in structure of the applications process for Resilience Funding. However, we have seen an increase in interest in the role of SSNs from other organisations, with the Museums Association and Art Fund becoming more engaged with SSN activity. This may be due to a recognition of issues in the sector that were presented by Neil MacGregor to the DCMS Countries of Culture inquiry in May[3], which emphasised the erosion of curatorial strength as posing a danger to local museums[4]. As a result, we have been actively involved in helping coordinate with other SSNs in an effort to present a more unified front in addressing common issues arising in the museum sector. This has resulted in a feature in the Museums Journal[5] and a panel session at the Museums Association 2016 conference. NatSCA also had a presence at the Collections Trust conference, where we talked about Natural History Near You and mechanisms for communicating within the sector.

Our AGM, which focused on how natural science collections inspire our connection to the natural world, was hosted by the Silk Mill and Derby Museum & Art Gallery and was attended by over 100 delegates. Evaluation suggests that attendees found it an overwhelmingly useful and enjoyable event. We noticed that there has been an increase in first-time attendees, which matches against our increase in new members. It's great to see the membership grow and we hope that this will encourage greater sharing of experience, allow for some fresh ideas, and give us a stronger voice when advocating for collections.

At the AGM we had a hitherto unprecedented contest for a committee role, which saw our long-standing Editor Jan Freedman hand over the reins of the Journal to Rachel Jennings - I hope you're enjoying her first effort! Magnanimous as ever, Jan has now taken over as Blog Editor and continues to offer support for Rachel from his experience in the Editor role. I would very much like to thank Jan for all his hard work and dedication over the years, and I am pleased to welcome Rachel to the committee. Returning from maternity

leave, Isla Gladstone has stepped into Emma Bernard's role as representative to the Geological Curators Group (GCG), as Emma is stepping down due to other commitments. I'd like to thank Emma for her efforts in helping keep the relationship between NatSCA and GCG so close over the last few years. Also returning from maternity leave is Clare Brown, who will be regaining responsibility for organising training from Vicky Purewal, who has done a sterling job while Clare has been away. If you are interested in joining the NatSCA committee, the next election will be at our two-day AGM in Cambridge on Thursday 20th April, so get your nominations in to our Secretary Roberto Portela Miguez by March 23rd 2017[6].

Two organisations were successful in applying for the 2016 Bill Pettit Memorial Award; the Museum of Life Sciences, King's College London and the Herbert Art Gallery and Museum. We were delighted to see how the Award was put to good use in the Nature Notes exhibition at the Herbert when we were invited to hold a committee meeting there in October. It was heartening to see the natural science collections are being successfully integrated with social history and art, helping to demonstrate how nature is an integral part of culture.

I would like offer my heartfelt thanks to the whole of the NatSCA committee and our team of excellent volunteers: Justine Aw, Glenn Roadley, Gina Allnatt, Emma-Louise Nicholls, Sam Barnett, David Notton, and Lee Davies. Finally, I want to offer special thanks to our Treasurer Holly Morgenroth, who plays an absolutely vital role in everything that we do.

Let's see what 2017 holds in store!

Paolo Viscardi (Chair)
December 2016

[1] Linnean Society, 2016. Reconciling the Nagoya Protocol requirements with Natural Science collections. [online] Available at: <https://vimeo.com/album/4186160/video/187320796> [Accessed 16 December 2016].

[2] Defra, 2016. Possession of wild bird eggs: establishing the grounds for an offence Summary of responses and government response to the consultation on proposed legislation in England and Wales. [online] Available at: <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/494610/wild-bird-egg-consult-sum-resp.pdf>

[3] Culture, Media and Sport Committee. Oral evidence: Countries of Culture, HC 864 Wednesday 4 May 2016. [online] Available at: <http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/culture-media-and-sport-committee/countries-of-culture/oral/32902.html> [Accessed 20 December 2016].

[4] Kendall, G., 2016. MacGregor warns of erosion of of curatorial strength in regions [online] Available at: <http://www.museumsassociation.org/museums-journal/news/11052016-macgregor-warns-erosion-curatorial-strength> [Accessed 19 December 2016].

[5] Stephens, S., 2016. Special interests. [online] Available at: <http://www.museumsassociation.org/museums-journal/features/01072016-special-interests> [Accessed 19 December 2016].

[6] Nomination form. [online] Available at: <http://natsca.org/sites/default/files/NatSCA_Election_nomination_form.docx> [Accessed 16 December 2016].

An overview of the Mammal Collection of Instituto de Biología, Universidad Nacional Autónoma de México

Fernando A. Cervantes*, Julieta Vargas-Cuenca, and Yolanda Hortelano-Moncada

Colección Nacional de Mamíferos, Departamento de Zoología,Instituto de Biología, Universidad Nacional Autónoma de México, AP 70-153, Ciudad Universitaria, CP 04510 CDMX, México

**Corresponding author: fac@ib.unam.mx*

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Abstract

Colección Nacional de Mamíferos (CNMA) is an important Mexican mammalian collection that meets international standards of curatorial procedures and follows domestic and international regulations. It holds the largest number of museum mammalian specimens from México of any Mexican biological collection, and keeps representatives of nearly 90% of Mexican taxa. Skins, skulls, skeletons, fluid-preserved specimens, and frozen tissues are the main preservation types. Most taxonomic representatives are small mammals such as mice, bats, shrews, and lagomorphs from almost every major political division of México, and ecosystems of temperate and tropical affinity. CNMA holdings contain important voucher specimens such as extinct taxa, endemic species, and unique specimens. Taxonomic and geographic data for most specimens are available online and also in digital file format including images. CNMA specimens actively contribute to environmental education and teaching through routine activities of its faculty, staff, and students. CNMA is successfully contributing to the inventory of mammals from México.

Keywords: Curation, CNMA, UNAM, Colección Nacional de Mamíferos, Mexico, biodiversity

Introduction

Colección Nacional de Mamíferos is one of the most important mammalian collections in México and Latin America, and dates from the mid-20th century (Figure 1; Cervantes, 2016). It is hosted by Instituto de Biología (IB) of Universidad Nacional Autónoma de México (UNAM) in Mexico City (Hortelano-Moncada et al., 2006), and its formal collection acronym has been CNMA since 2003 (Consejo Interno, 2003; Zambrano and Reynoso, 2003). The international standards of curation procedures of CNMA have been recognized by the Systematic Collections Committee of the American Society of Mammalogists (ASM), granting a Certificate of Accreditation to the CNMA in 1975, 1983, and 1995 (Figure 2). CNMA is included in a list of accredited collections in the Western Hemisphere that was compiled by the Systematic Collections

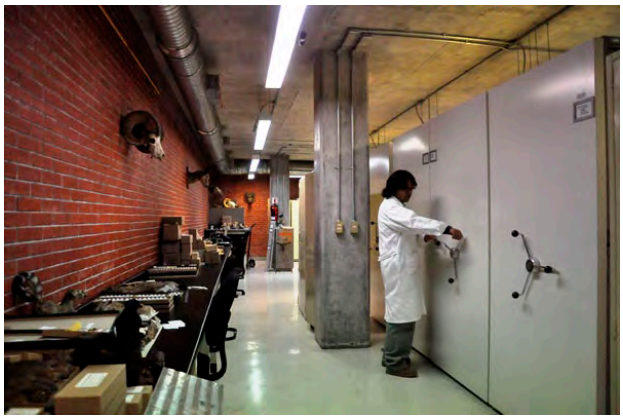

Figure 1. Panoramic view of the mammal collection (Colección Nacional de Mamíferos, CNMA) of Instituto de Biología, Universidad Nacional Autónoma de México, in Mexico City.

Figure 2. Certificate of Accreditation granted to Colección Nacional de Mamíferos (CNMA) by the Systematic Collections Committee of the American Society of Mammalogists in 1975, 1983, and 1995.

Figure 3. CNMA in the National Register of Scientific Collections issued by the environmental branch of the Mexican goverment (Secretaría del Medio Ambiente y Recursos Naturales).

Figure 4. Register of National Biologial Collections of Instituto de Biología, Universidad Nacional Autónoma de México, including Colección Nacional de Mamíferos (CNMA), as a CITES site.

Committee (Hafner et al., 1997). In addition, faculty, staff and students at CNMA follow the guidelines of the ASM for the use of wild mammals in research and education (Sikes et al., 2016), mainly relating to vouchering of specimens and ancillary materials. CNMA policy agrees with ASM's that deposition of specimens in collections maximizes benefits from each catalogued specimen, ensures access to data by any user, and provides vouchers for individuals or species used in published research.

In addition, to comply with domestic regulations on collecting permits and biological collections of México, CNMA is formally entered in the National Register of Scientific Collections, compiled by the environmental branch of the Mexican government (Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT)) under the register number DF.MA.022.0497, issued on 17 April 1997 (Figure 3). As expected, many of the specimens of CNMA are on the international list of threatened and endangered species of the Convention on International Trade in Endangered Species (CITES), whose trade is closely regulated by national and international agencies. In order to export and import specimens for research purposes, CNMA needs a special certification from CITES. In México, such recognition is issued by SEMARNAT (local administrative authority of CITES), which accredited CNMA as CITES site no. MX-007, along with other national biological collections at Instituto de Biología (Figure 4).

The Collection

CNMA holds nearly 48,000 catalogued museum specimens of mammals, which include representatives of all the mammalian orders reported for México (Table 1; Boisserie et al., 2005; Ramírez-Pulido et al., 2015; Guevara et al., 2015). Small mammals such as rodents and bats are the mammal groups with the highest number of species in México (together comprising 70.4% of the total of 550 Mexican mammal species, including land and marine forms; Ceballos and Arroyo-Cabrales, 2012). Unsurprisingly, they comprise the bulk (45,495 out of 47,295 specimens = 96.2%) of holdings at CNMA, along with carnivore, rabbit, and shrew specimens. Recent listings at CNMA indicated that nearly 90% of mammal species reported for México have representatives therein.

Preserved mammal specimens at CNMA include stuffed skins, tanned skins, skulls, complete skeletons, individual bones including bacula of mice, horns, antlers, tissues frozen at -75°C, and fluid-preserved specimens. Other ancillary materials of CNMA include plaster casts of footprints, collected mostly in the field. The source of specimens that arrive at CNMA is mainly research projects, either from research groups at UNAM or other Mexican institutions. Moreover, Mexican environmental authorities commonly hand over mammal materials confiscated from smugglers, animal traffickers, illegal hunters, and illegal mammal souvenirs seized by customs. Zoos and other public or private facilities also donate dead mammals, their parts or products to CNMA.

Table 1. Collection records of Mexican mammals by Order, held by the mammalian collection (Colección Nacional de Mamíferos; CNMA) of Instituto de Biología of Universidad Nacional Autónoma de México.

Mammalian Order	Number of holdings	Common names	Species occuring in:	
			Mexico	Solely New World
Rodentia	24450	Mice, squirrels, gophers, porcupines	X	
Chiroptera	18268	Bats	X	
Carnivora	1087	Bears, foxes, racoons, otter, ocelot	X	
Lagomorpha	1064	Rabbits, hares, jackrabbits	X	
Eulipotyphla	966	Shrews, moles	X	
Cetartiodactyla	681	Jabalin, deer, bison, dolphins, whales	X	
Didelphimorphia	463	Opossums	X	X
Cingulata	67	Armadillos	X	X
Primates	26	Monkeys	X	
Pilosa	21	Anteaters, tamandua	X	X
Perissodactyla	15	Tapir	X	
Sirenia	14	Manatee	X	

As expected, native mammal species make up the majority of CNMA holdings. The earliest numbers in the collection catalogue correspond to Virginia Opossum (*Didelphis virginiana*) specimens (skin and skull) from México and the United States of America. These were collected, skinned, and stuffed in 1938 - 1945. The five Mexican political divisions or states with the highest number of collecting records (Table 2) are territories that are mostly represented by an interesting array of diverse ecosystems such as tropical rain forest, tropical dry forest, cloud forest, temperate forest, grassland, mangrove, and xeric shrublands. Therefore, holdings at CNMA are evidence of the rich biological diversity of Mexican mammals.

Moreover, CNMA holds specimens from several countries representing all world continents except for Antarctica (Table 3), although African specimens came solely from captive facilities. Other important holdings are specimens of the endangered Mexican Wolf (*Canis lupus baileyii*, CNMA-24555; Figure 5) the extinct Monk seal (*Monachus tropicalis*, CNMA-24563), and fluid-specimen individuals and skeletons of the critically endangered Vaquita Marina (*Phocoena sinus*, CNMA-19588, 19589). The Vaquita is a small and secretive porpoise, endemic to a small range in the northern Gulf of California, México. Similarly important holdings are two specimens of the recently catalogued Big Gopher (*Orthogeomys lanius*, CNMA-46463, 46483), microendemic to a small region in the mountains south and east of Pico de Orizaba in Veracruz. This fossorial rodent, unknown to science since the first two specimens were captured in 1904, was rediscovered in 2013 (Hafner et al., 2014); its conservation status has not ever been assessed, although the Mexican government has listed it as threatened since 2010 (Herrera Flores, 2010).

Figure 5. Skull of Mexican wolf (Canis lupus baileyi, CNMA-24555), extirpated from Mexican grounds for nearly half a century.

In 1983, 26 type specimens belonging to 15 taxa were held in the collection (Urbano Vidales & Sánchez-Herrera, 1983). At present, 12 holotype specimens highlight the Type section, including taxa of rodents, bats, carnivores, and shrews (Table 4; Hortelano-Moncada et al., 2006). It is interesting to note that the first holotype specimen deposited at CNMA, in 1941, was the Peter´s Climbing Rat (*Tylomys gymnurus*, CNMA-101), and at present it is still recognized at the subspecific level. The last holotype specimen catalogued at CNMA was the Delicate Deer Mouse (*Habromys delicatulus*; CNMA 22439), a monotypic species endemic to the cloud forest of the mountains of Central México (Carleton et al., 2002).

Table 2. Collection records of Mexican mammals by Mexican political divisions (states), held by the mammalian collection (Colección Nacional de Mamíferos; CNMA) of Instituto de Biología of Universidad Nacional Autónoma de México.

Number of state	State	Number of holdings	Number of state	State	Number of holdings
1	Oaxaca	4985	17	Nayarit	930
2	Guerrero	4203	18	Tamaulipas	740
3	Chiapas	3615	19	Guanajuato	624
4	Veracruz	3476	20	Campeche	597
5	Puebla	3311	21	Coahuila	583
6	Jalisco	2476	22	Sinaloa	570
7	Baja California Sur	2313	23	Yucatán	543
8	Morelos	1874	24	Zacatecas	518
9	Ciudad de México	1825	25	Tabasco	512
10	Estado de México	1581	26	Quintana Roo	497
11	Colima	1461	27	Tlaxcala	440
12	Durango	1386	28	Querétaro	387
13	San Luis Potosí	1248	29	Hidalgo	377
14	Sonora	1173	30	Chihuahua	364
15	Michoacán	982	31	Nuevo León	340
16	Baja California	969	32	Aguascalientes	131

*Table 3. Collection records of Mexican mammals by country hold by the mammalian collection (Colección Nacional de Mamíferos; CNMA) of Instituto de Biología of Universidad Nacional Autónoma de México. (*undetermined country)*

Number of country	Country	Number of holdings	Number of country	Country	Number of holdings
1	Mexico	45917	19	Nicaragua	5
2	United Sates of America	681	20	French Guiana	5
3	Argentina	198	21	Guatemala	4
4	Colombia	105	22	Africa *	4
5	Trinidad & Tobago	93	23	Haiti	4
6	Costa Rica	72	24	Poland	3
7	Brazil	60	25	El Salvador	3
8	Belize	58	26	Czech Republic	2
9	Undetermined	48	27	Chile	2
10	Venezuela	48	28	Honduras	2
11	Panama	47	29	Sweden	2
12	Peru	35	30	Australia	1
13	Canada	34	31	Philippines	1
14	Rusia	32	32	France	1
15	Bolivia	23	33	Indonesia	1
16	Cuba	10	34	Iceland	1
17	Spain	8	35	Japan	1
18	China	5	36	Madagascar	1

Table 4. Holotype specimens hosted by the mammalian collection (Colección Nacional de Mamíferos; CNMA) of Instituto de Biología of Universidad Nacional Autónoma de México.

Type, catalogue number, gender, authority name and date	Present valid taxon name, authority name and date	Family and Order	Preservation type
Holotype, CNMA-101, ♀ *Tylomys gymnurus* Villa R., 1941	*Tylomys nudicaudus gymnurus* Villa, 1941	Muridae, Rodentia	Skin and skull
Holotype, CNMA-8516, ♀ *Tylomys nudicaudus villai* Schaldach, 1966	*Tylomys nudicaudus villai* Schaldach, 1966	Muridae, Rodentia	Skin and skull
Holotype, CNMA-22439. ♂ *Habromys delicatulus* Carleton, Sánchez y Urbano Vidales, 2002	*Habromys delicatulus* Carleton, Sánchez y Urbano Vidales, 2002	Muridae, Rodentia	Skin and skeleton
Holotype, CNMA-8496, ♀ *Orthogeomys grandis alvarezi* Schaldach, 1966	*Orthogeomys grandis alvarezi* Schaldach, 1966	Geomyidae, Rodentia	Skin and skull
Holotype, CNMA-221, ♂ *Orthogeomys grandis huixtlae* Villa R., 1944	*Orthogeomys grandis huixtlae* Villa R., 1944	Geomyidae, Rodentia	Skin and skull
Holotype, CNMA-12145, ♂ *Spilogale pygmaea intermedia* López-F. and Urbano V., 1979	*Spilogale pygmaea intermedia* López-F. and Urbano-V., 1981	Mephitidae, Carnivora	Skin and skeleton
Holotype, CNMA-212, ♀ *Potos flavus dugesii* Villa-Ramírez, 1944	*Potos flavus chiriquensis* J. A. Allen, 1904	Procyonidae, Carnivora	Skin and skull
Holotype, CNMA-8445, ♀ *Notiosorex phillipsii* Schaldach, 1966	*Cryptotis phillipsii* (Schaldach, 1966)	Soricidae, Eulipotyphla	Skin and skull
Holotype, CNMA-9246, ♂ *Nyctinomus depressus* Ward, 1891	*Nyctinomops macrotis* (Gray, 1839)	Molossidae, Chiroptera	Fluid-preserved
Holotype, CNMA-9243, ♂ *Vesperugo veraecrucis* Ward, 1891	*Perimyotis subflavus veraecrucis* (Ward, 1891)	Vespertilionidae, Chiroptera	Fluid-preserved
Holotype, *CNMA-8594,* ♂ *Rhogessa mira* La Val, 1973	*Rhogessa mira* La Val, 1973	Vespertilionidae, Chiroptera	Skin and skull
Holotype, *CNMA-1738,* ♀ *Cynomops malagai* Villa R., 1955	*Molossus rufus* É.-Geoffroy Saint Hilaire, 1805	Molossidae, Chiroptera	Skin and skull

The Collection as a Resource

CNMA is frequently visited by researchers and students. They mostly request to examine mammalian specimens for morphology projects, cranial and dental variation, patterns of reproduction, sexual dimorphism, size and biomass variation, and hair colour and structure, among other topics. Requests to take pictures of skulls and obtain permanent loans of frozen tissues for molecular systematics are common. In addition, not only mammalogists but researchers of other vertebrate groups request the services of the resident dermestid colony to clean bones. Recently, requests for specimen information in database format have noticeably increased.

The information of CNMA scientific specimens is currently being uploaded into a database. The results have been highly useful for the curation of the specimens. The management of the CNMA database has become a helpful tool that significantly helps store, retrieve, and analyse information on the specimens as an important part of the internal curatorial work at CNMA. For example, CNMA keeps a record in its curatorial database of specimens recently collected in the field or received from different sources, samples being cleaned in the colony of dermestids, skins and skeletons in fumigation, bone material being washed, skins in the process of tanning, specimens being fixed in formaldehyde before being preserved in alcohol, stored frozen tissues, nomenclature and classification of species, cataloguing of specimens, georeferencing of localities (when not registered in the field), national and international loans and permits for collection, export and import, among others. All of these procedures have helped CNMA to obtain international recognition for its high standard of curatorial practice.

The specimen database of CNMA is already available free of charge online, through the institutional website (https://datosabiertos.unam.mx/). Currently, there are nearly 37,000 records available. Our records show that CNMA holdings are intensively consulted online, and feed numerous research projects dealing not only with the presence or absence of species data, but with complex analyses such as niche modelling, biogeographical inferences, and impact of climate change, that require large mammalian datasets. Curatorial records from CNMA are also uploaded into databases of international projects, organisations, and agencies that help make field data on biodiversity available online using web portals, such as the Global Biodiversity Information Facility (GBIF; http://www.gbif.org/) and The Mammal Networked Information System (MaNIS; http://manisnet.org/).

CNMA products also include an online collection of digitised files, named IREKANI, containing images of specimens and their associated taxonomic and geographical metadata (http://unibio.unam.mx/irekani/; Figure 6; Cervantes and Vargas-Cuenca, 2012; Cervantes 2016). This dataset provides users that live away from biological collections with access to images of mammalian museum specimens, needed to make decisions about taxonomic identification. Similarly, ecologists and botanists interested in identifying mammalian skin or bone remains found in the field rely on this image collection as a vital resource. Moreover, this web site is heavily consulted and used by students and instructors in mammalogy and wildlife courses, and by popular science publications to illustrate what mammals look like, where they occur, and how they are named. Many of the IREKANI files that CNMA holds also function as voucher information for camera trap records. Editors of scientific journals frequently ask CNMA to corroborate identifications of new or noteworthy mammalian records obtained through camera traps that have been reported in manuscripts submitted for publication.

Figure 6. Digital file number 11903 from image collection of Colección Nacional de Mamíferos, available online (http://unibio.unam.mx/irekani/). Highly distinctive S-shaped enamel pattern of third upper right molar of Allen´s Woodrat (Hodomys alleni, adult ♀, CNMA-46965), a secretive cricetid rat endemic to the dry tropical forest of western México.

CNMA designed its own web page (cnmaib.wordpress.com), which includes information on how to contact and find CNMA, forms to request academic visits, specimen and frozen tissue deposits and loans, and access to the dermestid colony service. The website also shows panoramic views and particular images of CMNA's facilities, provides taxonomic and geographic data on important specimens (Figure 7), and free PDF files of relevant publications on Mexican mammals, including research articles and books. Information on

Figure 7. Images of the facilities at Colección Nacional de Mamíferos (CNMA) of Instituto de Biología of Universidad Nacional Autónoma de México.

faculty, staff, and students associated with CNMA is also made available therein.

CNMA is also an important facility that curators and staff utilise to teach mammalogy to students enrolled in undergraduate and postgraduate courses, give seminars and talks on curatorial matters, and participate in exhibitions and museographical activities and events outside campus (Cervantes et al., 2009). For instance, the teaching collection of CNMA is intensively used to support the laboratory section of the Mammalogy course taught in UNAM at undergraduate level. Regarding enviromental education, students associated with CNMA also help organize events using mammal specimens to teach children and adults of local communities how mammals function in nature, and how human beings may coexist with mammals to live sustainably (Figure 8).

Conclusion

In summary, CNMA has become an important and necessary source of information for those interested in the taxonomy and geographical distribution of Mexican mammals. Such information significantly contributes to the scientific knowledge of the diagnostic features of Mexican mammalian species and its biogeographical implications, and to the growth and enrichment of domestic and international databases on Mexican mammals, which are benefiting conservation efforts to sustainably manage this component of biodiversity. The main objectives of CNMA are maintaining and developing the national collection of Mexican mammals, and providing support to research, teaching, museography, and environmental education in México. At present, CNMA is moving ahead and has institutional support to continue its work (Cervantes, 2016).

Figure 8. Digital file number 12017 from image collection of Colección Nacional de Mamíferos, available online (http://unibio.unam.mx/irekani/). Comparative dorsal view of Mexican squirrel skins (top to bottom): Red-bellied Squirrel (Sciurus aureogaster; CNMA-6819), Ring-tailed Ground Squirrel (Notocitellus annulatus; CNMA-37243), Tropical Ground Squirrel (N. adocetus; CNMA-47466), and Southern Flying Squirrel (Glaucomys volans; CNMA-29).

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A tangible embrace with the invisible: How a curator can achieve collections goals in partnership with volunteers and the public

Jovita C. Yesilyurt[1]*, Ali L. Thomas[1], Edgley A. Cesar[1], Yoke-Shum Broom[2], Rehemat Bhatia[2], and Renee Miller[2]

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[1]The Natural History Museum, Cromwell Rd, SW7 5BD, London, UK

[2]Volunteers at The Natural History Museum

**Corresponding author: j.yesilyurt@nhm.ac.uk*

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Abstract

Volunteering and/or citizen science projects allow members of the public to participate in work that is not necessarily within their field of expertise, giving them the opportunity to support scientists, curators, and collections-based work.

Here we present a case study from the Natural History Museum that involved curators and researchers working with botanical collections alongside volunteers and the public. The programme had both scientific and educational goals. The particular case discussed here is a project which has been run during 2013/2014 under the volunteer initiative entitled V Factor, which involved curatorial tasks such as databasing and digitising material from the Museum's diatom collection and transcribing handwritten notes. The end products have included the construction of an open access website focusing on diatoms, with information about the collections, an online media gallery, and digital documents, blogs and information for the layperson or expert. This paper also presents further successes and lessons learnt from the programme and the collaboration.

Keywords: citizen science, collections, curation, diatoms, public engagement, V Factor, volunteers

Introduction: Curation in the age of citizen science

Museums and similar institutions that house a multitude of different collections have the duty to provide access to these resources, either via exhibitions or by providing access to the data and/or specimens via loans and visitors (e.g., researchers, artists, etc). This is especially important for natural sciences research, e.g. for mapping biodiversity, identifying new organisms, preventing loss of biodiversity, and also for the wellbeing of society (further reading at Borgonovi, 2008 and Casiday et al., 2008). More recently, this 'relevance' has been expanding beyond scientists, and there have been many new instruments and techniques used to create a dialogue between science/scientist and public/society, shifting from more passive learning to more active participation.. Public and visitors can now have some opportunities to be present behind the scenes and take part in 'hands on' activities with the collections and materials that may be exhibited, rather than just passing by and photographing and reading the notes and labels from the galleries.

Recent changes in technological platforms can provide access to diverse and readily-available information, e.g. databased collections (Haklay, 2013). These possibilities are encouraging the development of a 'culture of participation' (Fischer, 2011). Citizen science, online volunteerism and crowdsourcing are no longer a trend, but something that is becoming an integral part of the work of various institutions, including museums. Public participation in scientific research is not new (Bonney et al., 2009); indeed, a culture of volunteerism at the Natural History Museum (NHM) was established at the Museum's conception in 1881, and formalised with the arrival of its first volunteer coordinator in the early 1990s. But new technologies are shifting how scientific information can be made easily available, as well as who can engage with it and how. Other projects exist where the public take part (e.g. The Birdhouse Network (TBN; Leonard, 2007), eBird (Sullivan et al., 2009), Cornell Laboratory of Ornithology (CLO; 2014; Bhattacharjee, 2005), Galaxy Zoo (Raddick et al., 2010), The Great Sunflower Project (2014)), and they are achieving multiple goals for institutions and the public.

Help from voluntary contributors has had a large, positive impact on museum research and curation, especially due to recent financial constraints (e.g., Bolton & Cooper, 2010). Such projects have broadened the scope of research and enhanced the ability to collect scientific data (Cohn, 2008). Some citizen science projects have already been remarkably successful in advancing scientific knowledge (Bonney et al., 2009).

Citizen science and volunteering have the potential to create the world's largest research team - an endless resource of motivated, passionate, and empowered people. But projects that yield both scientific and educational outcomes require careful planning (Bonney et al., 2009). There is the need to develop effective standardised protocols and ensure that they are linked with an institution's strategy.

It was in this context that the V Factor ('VF' hereafter) programme was initiated by the NHM. VF is aimed at supporting the museum's research and curatorial work, providing access to collections and data, and increasing awareness of what staff at the NHM do, by getting volunteers involved directly with collections-based tasks and providing face-to-face interactions with the visiting public (Miller et al., 2013). Face-to-face engagement is a current (2015 - 2020) NHM strategy, part of the original legacy to 'benefit the public as well as the expert naturalist' (Trackray and Press, 2001). The VF model specifically makes the collections accessible for the external scientific, and non-scientific, community.

The aim of this paper is to publicise the collaboration and share lessons learnt so that the VF framework and techniques could be adopted and adapted by others to achieve not only curatorial but also educational and scientific goals. Also provided is our celebration of the achievements and possibilities for further accomplishments as a result of this endeavour. It provides evidence that the general public (possibly untrained and non-specialist) can gather and transfer scientific data of good quality, and help towards management of the collections. This challenges the perception (anecdotally heard amongst some curators and collections managers) that most of the core curatorial work cannot be done using a 'citizen science style' approach. This is due to the nature of the tasks and responsibilities involved; therefore, it is not a very common arrangement for volunteers to take part and support core curatorial work, which may require decision-making, except for some elementary tasks (e.g., reboxing, relabelling, sorting).

The term 'citizen scientist' is usually used to describe those who participate in scientific research projects and carry out 'citizen assisted science' projects, designed to support and expand science (Rossiter et al., 2015). The project discussed in this paper (Diatoms: making the invisible visible) was designed to provide curatorial support ('citizen assisted curation') for future research purposes. Curation in the NHM is considered to be a means to maintain and care for the collections. We believe that the experiences shared here may change this perspective so that citizen science methods can be successfully employed in many curatorial tasks. What follows is a consideration of the tools that can be used to ensure success.

Methodology

1. Construction of a programme: How VF came about and how it works

VF is one strand of the NHM volunteer programme. It is inclusive, open to anyone 18 or over who is available to take part for one fixed day per week for ten weeks. The programme was initiated in 2012 and has been running continuously since that time. It is a way in which the NHM can increase public engagement with collections, and improve access to collections, information, and expertise – a major NHM aim. In addition, it can educate and entertain some of the five million visitors per year that pass through the Museum's doors. Finally, it is a novel approach that can promote staff development and help to redress decreasing resources.

The initiative takes place in the Specimen Preparation Area (SPA) of the Darwin Centre, a lab on view to the public (Figure 1). Specialist scientific staff and a volunteer coordinator manage the programme, assisted by volunteer leaders. The area was designed to bring NHM science and collections to life: real science, real collections, and real experiences. This is also what makes the space and the programme so unique in its approach and challenges. Further details about the VF programme can be obtained from Miller et al. (2013).

Figure 1. View from the public galleries into the SPA lab (Specimen Preparation Area, Darwin Centre).

The public seem to look for and value face-to-face interactions and 'hands-on' activities in many museum locations. For those unable to attend a museum, there are now also possibilities associated with remote volunteering and citizen scientist participation offsite or from home. Amodio (2008) has stated that, to face these needs, museums are implementing a vast array of instruments and applications. The VF initiative involves a number of fairly short term projects, each a year-long collaboration, that involve working directly with potentially fragile natural history collections. For others less able to contribute in this way, a crowdsourcing element was introduced.

Falk and Dierking (2000) have highlighted how 'mediators' (explainers) play a critical role in personalising a museum experience for visitors, facilitating their efforts to learn and find meaning. According to Bonney et al. (2009), an educator is required for a citizen science project, to explain the project's importance and significance to participants, to pilot and field-test protocols with potential participants, to develop clear and comprehensive project support materials, and to ensure appropriate participant feedback. In the NHM there are Science Educators who can discuss individual objects/specimens and wider issues with visitors. However, VF goes further in showing the science and curatorial work currently being carried out by museum staff, highlighting the Museum as a research institution. VF may not appear, at first sight, to be a traditional citizen science scheme, but it does demonstrate what goes on behind the scenes. It also allows for non-scripted conversations/ interactions with the public relating to our science and collections. Props and activities are designed to suit the wide range of visitors.

VF collaborations are thus designed to provide suitable support (personnel and planning) to meet the objectives of both the NHM and the persons (curators and/or researchers) involved. This encompasses a considerable amount of preparation, as described below.

2. Putting together the Diatom project: Making the invisible visible

A VF project could involve sorting, observing, studying, measuring, cataloguing, etc., so long as it has clearly-defined and desired outcomes for a researcher/ curator and the volunteers taking part, as well as the Museum. The project discussed here was the second collaboration carried out under the umbrella of VF, and focused on the NHM's extensive diatom collection. It was carried out in 2013 – 2014. Diatoms are microscopic photosynthetic aquatic organisms (also called 'algae'). The collection includes glass microscope slides with wide temporal and geographical area representation, archival handwritten notes, drawings and illustrations, and photographs of diatoms. Information relating to a particular object/specimen is contained in more than one 'material' (i.e. slide and handwritten notes). The various aspects of this collection had not been brought together due to historical and human resource issues. The aim of this VF collaboration involving diatoms was to digitise a set of the diatom collection material, more specifically, the collection of the Victorian naturalist Thomas Comber.

Digitising vast amounts of data extracted from different types of collections and artefacts, and cross referencing and linking this information, can be labour-intensive. Activities involved included virtual archiving, (i.e. capturing and transcribing data from slide labels and handwritten notes), creating digital surrogates (i.e. digital copy that works as a substitute and/or replacement), and carrying out quality assurance. Although this could be done by a digitiser together with a curator, we wanted to actively engage passionate, interested volunteers accompanied by experts for this work.

The strength of any citizen science programme relies on the curiosity and pleasure associated with learning (Devictor et al., 2010). Diatoms are not widely known by the public, and thus might not be an immediately appealing subject. Moreover, they are invisible to the naked eye. However, through the theoretical and practical aspects involved in the VF framework, the diatom project easily provided curiosity and pleasure: the volunteers were captivated not only by the training and information packages they received, but also by their involvement in processes such as decoding and transcribing genus and species names from often illegible or abbreviated handwritten sources. Some of the species names caught the volunteers' attention, and they became interested in seeing some of these invisible 'creatures' and learning the meanings of their names. This included species named after a person, feature, or locality, e.g., *Aulacodiscus comberi* (homage to T. Comber); *Navicula communis* (very common species, found everywhere); *Biddulphia novazeilandica* (from New Zealand).

In the view of Bonney et al. (2009), a citizen science project should have: a) set-up protocols, b) data forms, c) supporting educational materials (hand-outs, guidelines, tips, etc), d) opportunities for training, and e) a view of the data gathered. The diatom project presented here fulfilled many, if not all, of these criteria. The project relied principally on three members of Museum staff: the volunteer coordinator plus two members of the diatom curation team. The project also benefitted immensely from the invaluable assistance of volunteer leaders. These are volunteers who have a deeper understanding of the work, and a longer-term relationship with the Museum. This group are committed to VF, and bring initiative, creativity, and depth of experience to the framework and day to day operation of the programme. For example, they are instrumental in preparing props for the public discussions outside the lab. Since diatoms are invisible to the naked eye and the public cannot touch or listen to them, they are difficult to present to visitors. The volunteer leaders helped make the invisible visible.

3. Establishing protocols

a) Organising training modules and packages

As noted by Bonney et al. (2009), developing and implementing public data-collection projects yielding both scientific and educational outcomes does require significant planning and effort. The VF framework is designed to meet the project ambitions and give back to the volunteers, whilst also benefitting the public and the scientists/curators carrying out the projects. The investment made by staff was quickly rewarded by the volunteer output in producing results (i.e., data). Many of the suggestions here may sound obvious, but they are necessary because museum professionals often take them for granted.

The VF framework (training modules and some content; more details in Miller et al., 2013) has been re-used as the foundation for each collaborative project delivered under VF. However, some aspects are changed or adaptated to fit the project goals and tasks. For the diatom project, it was important to decide how best to convey the science, the rationale behind the project, and the nature of the tasks involved. In order to have an efficient training package/framework and, consequently, effective outcomes when planning such a project, several factors need to be considered:

- Opt for a simple and easily understood database entry programme, preferably one that would auto-populate fields to minimise the capacity for human error, and the addition of recommended links to undertake searches quickly and simply. We used Microsoft Excel, rather than the in-house database system, as it is user-friendly for the volunteers and easily adaptable for museum professionals to assess quality. It is also easy for data to be transferred to other types of data management system. One needs to also consider that there might be people with very basic computing skills, and it is also important for them to see what they are doing and undertake the task readily.
- Create simple exercises with step by step examples of what is needed to be done and why, to be used on the first day/s to familiarise the new volunteers with the workflow expected. This helped to show the logic, reasoning, and context of what was to be done.
- Have and make available extra resources and sources of information that enhance and reinforce training and knowledge (e.g., in our project: risks to the collections and possible ways to mitigate the risks; how to prepare a slide, etc.). This helps to communicate the reasons behind each task or guideline, illustrating why it is important and how it all started. It instigates curiosity, and expands the volunteers' views and skills, which could be linked to their day-to-day life (see further examples below).

b) Transferring knowledge

Riesch and Potter (2014) describe citizen science projects where attempts have been made to discover learning outcomes and ways of delivering useful information. Evaluation is embedded into the VF framework, to ensure that participants are making

full use of their time and working towards the goals of the project. Importantly, the evaluation also reflects on the enjoyability and productivity of the volunteer experience. Thus, all VF volunteer participants were asked for an evaluation every other session. Learning was captured via quizzes in the final session of the ten weeks, with activities such as mind mapping (in sessions one and ten), and with 'building-blocks' (hand-outs and other information) to reinforce learning.

One good example of transferring skills and knowledge is that the volunteers are usually asked to bring in one or two objects of their choice, which are used throughout the 10-week term. These are used to explain concepts such as collecting, labelling, curating, caring, rules of access or handling/using, alongside other skills such as communication, organisation, taking instructions, punctuality, as well as the notion of what being a curator entails. During the databasing activity, we gave the volunteers learning opportunities on troubleshooting, interpretation, and decision making (e.g., which species is being referred to; which to choose if something is missing, etc.).

c) Dealing with issues

i. Commitment

Experts/scientists/curators might have concerns about how to interest people in signing up for VF, and then how to maintain their interest during a project. Promotional material was prepared to help in this regard. Factors such as insights into the collections and the Museum, face to face contact with curators/researchers, hands on activities with real and historical collections, and development of skills and knowledge were mentioned. It was acknowledged that one of the main benefits of VF is that volunteers are present in the Museum where they meet staff, the public, and other volunteers. D'Souza et al. (2011) mentioned that the social factor seemed be one of the significant reasons why people sign up for volunteering or a similar commitment. We are not clear if this was one of the main reasons, but some individuals stated that they enrolled mainly to get a 'behind the scenes' opportunity and to be involved with scientists and natural history collections. It is believed that providing some details of what was expected of volunteers, and what they would be working on, probably helped potential participants to decide whether or not to sign up.

ii. Credibility of the data

Riesch and Potter (2014) showed that the subject of data quality worried most scientists involved with citizen science, although it did not pose a total stumbling block for their enterprises. Others have addressed similar issues. For example, Bonney et al. .(2009) have written that the creation of accurate data depends upon providing three things: (a) clear data collection protocols; (b) simple and logical data forms; and (c) support for participants to understand how to follow the protocols and what to do if in doubt. Riesch and Potter (2014) listed some of the approaches that have been used to ensure that errors in data quality can be minimised.

The project discussed here had some 'problematic complex' elements that the curators and volunteers would be faced with, aside from databasing. These were tasks such as extracting information from handwritten notes, transcribing taxonomic names, and doing repetitive tasks involving unfamiliar microorganisms. The volunteers might have also felt under pressure to keep specimens safe, as they were all incredibly fragile. Poor data quality and high risks to the collection were considered to be problematic by the curators in the diatom project, but they did not prevent the decision to go ahead. This collaboration is proof that it is possible to involve potentially non-specialist and previously untrained members of the public in curatorial work and have a positive outcome.

In this project, the database was created from handwritten notes, so steps were taken to assist deciphering and transcribing. In addition, human error was avoided, whenever possible, by using drop-down lists and online databases for reference, such as California Academy of Sciences Diatom Collection Database (http://researcharchive.calacademy.org/research/diatoms/names/index.asp). Also, the data-entry programme, Microsoft Excel, helped to 'monitor' the data captured by flagging possible mistakes. Finally, quality assurance was carried out by the curators throughout the year-long run, and on completion of the project. Checks and data entry monitoring were executed during the time the volunteers were doing the tasks. Further elements of quality assurance were performed at the end of the 10-week block, as the data produced by a team needed to be consolidated with the data produced by the previous team. This was carried out by the curators and volunteer leaders.

This protocol follows some of the recommendations of Riesch and Potter (2014). For instance, the curators offered training, mentorship, and close supervision, whilst encouraging volunteers to cross-check each other's data during the first three weeks. Face-to-face support for queries was considered essential to ensure a smooth operation and high quality data collection. The processes of reading, searching, checking, copying, confirming, learning where to look for answers, how to compare and/or revise, and how to redo and/or correct if a problem arose, are 'building-

blocks' of knowledge, skills, and confidence.

Although some errors should be expected, and some are unpredictable and/or missed, many can be anticipated, and therefore protocols and processes can be put in place to minimise them. Most of the errors occurred due to the fact that some collections may have inherent problems (e.g., labels with misspelled names, obscure localities, out of date taxonomy).

iii. Handling collections and fragile material

To minimise risks to the collections, such as breakage, misplacing, damaging, losing, effective protocol training was provided. Again, the volunteers' own material was used and imaginative situations (e.g. damage, loss, etc.) were presented to them so that they could reflect on the consequences, such as specimen replacement, or misplaced labels. Other risks were also explored and discussed, and minimised by providing the volunteers with protocols (e.g., how to scan fragile documents, avoiding food in the area, etc.).

Figure 2. View from inside the SPA lab with volunteers carrying out databasing.

Results and Discussion

The VF volunteers came from various educational (basic/A-level to PhD), employment (cashier, house-wife, professional) and nationality backgrounds (UK, Japan, Italy, Spain, etc.). On average, each VF volunteer processed 13 slides per session, with no breakages or damage to the fragile handwritten notes or slides (Figure 2). They sometimes spotted problems themselves that had passed through unnoticed (e.g. missing or misplaced handwritten notes, or geographical information wasn't matching, etc.). On a typical (non-holiday) day, the Volunteer Leaders had on average 12 interactions with members of the public (from single individuals to large school groups) outside the SPA, each for approximately 12 - 20 minutes.

Using the methodology defined here, the following results have been achieved:

Volunteer and staff outcomes

There has been no shortage of applicants, and those selected continued to be useful throughout the duration of their time at the Museum. VF projects at the NHM are run in-house, so there is no need for a strong publicity campaign to attract participants (as suggested by Rossiter et al., 2015). Although the numbers signing up for VF were large - we received well over 80 applications for this collaboration - we limited the participants to eight per 10-week session, to best meet the needs of the project and the volunteers, and ensure a quality experience for all.

The volunteer participants demonstrated their satisfaction with the diatom collaboration through the evaluations offered to them. Here the average rating was 8 out of 10 for their overall personal benefit and enjoyment from the initiative.

Learning has been demonstrated. For example, the mind mapping exercises carried out (which included the questions 'What is the role of a Museum?' and' Why it is important to make accessible the collections?') showed that, between week one and week 10, the answers expanded from 10-14 to 25-30 associations. The vocabulary in session 10 included words such as 'research', 'curation', 'conservation', and 'taxonomy', while on the first session there was 'curiosity', 'fun', 'escaping from rain or cold days', 'entertainment', etc. This shows that there has been a much improved participant understanding of science processes, curatorial needs, and collections care.

Volunteers were able to create accurate and meaningful results. By the fourth session, queries or doubts were often sorted out between volunteers themselves. Having a simple task design was one of the key factors for diminishing errors. Also, having extra tools to empower them and help problem-solving, searching, making decisions, and entering data contributed to faster and more reliable inputs. In fact, data quality issues have been estimated as being

problematic for only 10% of the data gathered, and the problems were mostly related to excessive and unnecessary information or orthographic errors, rather than incorrect data or wrongly-transcribed information. With regards to digital images, some of the problems occurred when material was imaged with other papers or notes close to, or underneath, the handwritten notes, producing an image of the document that did not meet the desired standard. Quality checking exposed the high quality of the work achieved by the volunteers. This certainly was the result of a well-designed, step-by-step task, coupled with establishing a solid protocol, workflow and training.

It has been acknowledged that crowdsourcing platforms are expanding rapidly (Fitzpatrick, 2012), and that their involvement in less obvious or well-known projects is increasing (Cohn, 2008, described as 'less interesting' projects, which might mean those with very repetitive and uniform tasks, for instance, counting and marking the number of objects/items from an image). The project discussed here involved diatoms, which are not well-known organisms and cannot easily be seen, which could render it a less attractive endeavour. The project aimed to make the invisible (diatoms) visible for the volunteers and the public. The volunteers, and in turn the visiting public, also learned of the organisms' importance (e.g., production of oxygen, basis of the marine food chain, usage in filtering processes, etc.). The collections themselves might not be colourful or attractive, and some tasks were rather repetitive - as most databasing tasks are - but appreciation of diatoms and the Museum's collection grew among the volunteers as the project progressed. This was demonstrated by the volunteers expressing interest in seeing what the organisms looked like, especially if they had come across a species name that they could relate to their day-to-day life.

The project developed collections-related skills and produced improvements in confidence and employability for the volunteers and internal staff members. Cooperative learning and support skills were also gained by all involved. Three VF volunteers joined our Volunteer Leader team, and seven others signed up for further volunteering elsewhere in the Museum (as of 2014). The Assistant Curator on the project was promoted to Curator in August 2015, as the VF opportunity enhanced and developed further his competencies for collections care and management.

Curatorial outcomes

The project focused on the Thomas Comber diatom collection, and produced many direct curatorial outcomes:

- All the slides (c. 3000) were databased and the associated notes scanned/digitised (c. 3500).
- T. Comber's geographical notebook has been digitised and its data transcribed, with some places and/or localities being traced and an updated name and/or political geography annotated. About 948 different localities have been listed and updated, following data protocols already established by other digitisation projects. This information will be part of the geographical data list in the NHM database.
- The bottle collection (c. 300 bottles) associated with the T. Comber diatom material has been databased, and when related to a slide, this connection (cross referencing) has been made.
- The T. Comber collection (i.e., slides and bottles) has been audited, with its condition reported and required remedial conservation work listed. Some cases have already been addressed.
- There has been an increase in both scientific and non-scientific enquiries relating to the diatom collection and the T. Comber material held at the NHM. Some of the material will be part of a project with international collaboration.
- Improvements are now in place in the operational and management aspects of these collections, so that there is more efficient and effective access to the T. Comber collections.
- Improvements have been made in the documentation and contextual information of the T. Comber collections (e.g. further material being linked to this collection).
- The portal 'Diatoms Online' (http://diatoms.myspecies.info/), which was established in association with VF and is currently in the process of being updated and changed, is now an extra source of information for the collection and its specimens.

Additional outcomes

- A Sci-Art workshop focusing on diatoms (function, form, structure, use, value and beauty) took place together with Central St Martin's School of Art & Design, in which the artists were asked to create or design a 3D representation of these organisms. The winners had their pieces on display at the NHM.
- The Blackheath Embroiderers' Guild created a piece of artwork based on diatoms, which was displayed in the SPA lab.
- A talk was given at the Citizen Science Cybersummit

(21 February 2014) at University College London, on 'Citizens, Science and Education'.

- External showcases were given to representatives of the National Museum of Science and Nature in Tokyo and Chapman University (US) in 2014.
- 'Digital volunteering: a case study on V Factor and Diatoms' is available from the Museums Association website: http://www.museumsassociation.org/museum-practice/new-approaches-to-volunteers/your-volunteer-case-studies.
- A poster ('Increasing engagement with collections through inclusion programmes: an example from The Natural History Museum, London') and a talk was presented during a workshop held at Manchester Museum in December, 2014
- A public open day was held in the Specimen Preparation Area at the NHM in July 2014 to celebrate 'V Factor: a year-long collaboration with diatoms'. We welcomed 45 visitors and 25 staff members.
- There were two in-house seminars for staff on completion of the collaboration, to report on successes. One focused on Diatoms Online, and the second on 'V Factor: A yearlong collaboration with diatoms'.
- A water sample with diatoms from the NHM Wildlife Garden was included in the 'Museum of Water' exhibition at Somerset House, London, in June 2014.
- Some material from New Zealand has been examined by an internationally-renowned artist, who produced a small exhibition in New Zealand, which accompanied a published booklet.

We are therefore able to state that we reached and exceeded all of the curatorial goals set for the project. Included in this was the aim to have all the slides in the T. Comber collection databased and the associated material digitised. This shows that the VF framework can work, and confirms Cohn's (2008) conclusion that involvement with 'less interesting' projects can be made appealing if it is explained what the organisms are, why they are important, and why the project is relevant to the museum and the scientific community. This makes clear to the volunteers that their efforts and dedication are worthwhile.

Further work

There is still some work to be done to achieve the full spectrum of collections management and access goals for this particular set of collections. For example, there are photographs taken by T. Comber that have not yet been curated, and some of these are related to the slides. Links should be determined and images taken, to obtain optimum quality. There are also lantern slides of the photographs that could also linked to the data, and the potential of this material as a resource reviewed, so that they could be more useful. These lantern-slides demonstrate how specimens were recorded in the past, in addition to drawings and illustrations, so it would improve links to the historical aspects of this collection. It will be very important to have images of the species that have been databased and linked to particular slides, projects, or Type material. Whenever possible, and material is available, it would be useful to recreate the morphological information (e.g, create new slides and/or use the SEM from the bottle collection, especially for the Types).

It will be also important to clarify the taxonomy and nomenclature, particularly of the Type specimens recorded in this collection, and also check the publications or protologues for those slides where T. Comber noted that there were Types, as they might contain new species that T. Comber didn't have time to publish or describe.

In order to maximise on the research outcomes of a collaboration of this kind, it would be helpful to georeference the localities. It would also be useful to ensure that all the names listed in T. Comber notes for each slide were made searchable online. So far, only one name/species is listed per slide, in order to link and represent the slide.

Conclusion

We believe it is worth re-emphasising a few aspects when proposing a similar project:

- Establish the project involving a team where volunteers could also take part and have a say, including testing beforehand.
- Ensure a continuous investment and review of the protocols and processes, and ask the volunteers what they think.
- Provide an immediate response to enquires and doubts, and share the responses so that the skills and knowledge are transferred.
- Develop a project and standards that can be re-used by others and in other locations.
- Illustrate, record, photograph, video-record and/or document all the processes undertaken.
- Celebrate the value of volunteer engagement in meeting the objectives of the project.
- Acknowledge the activities being carried out

internally and externally (e.g., on the web) at regular intervals, not only at the end of the project.

Finally, we would like to find funds and/or volunteers to continue this work and perhaps tackle other collections, which are at least equally as important as that of T. Comber. Anyone who is interested, or has other ideas, is invited to get in touch with the authors.

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The Lepidoptera Collection of Henry Walter Bates at the Oxford University Museum of Natural History

Gina Allnatt

Hope Entomology Collections, Oxford University Museum of Natural History, Parks Road, Oxford, Oxfordshire, OX1 3PW, UK

email: gina.allnatt@gmail.com

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Abstract

Evaluation and research into the Lepidoptera collections at the Oxford University Museum of Natural History find part of Bates' personal collection, complete with his original labels, as well as syntype material from his paper New Species of Butterflies of Guatemala and Panama, which was published in The Entomologist's Monthly Magazine 1864 - 1866.

Keywords: Bates, Lepidoptera, Henry Walter Bates, Oxford University Museum, Nymphalidae, Butterflies

Introduction

The Oxford University Museum of Natural History (OUMNH) houses over six million entomology specimens. Approximately two million of these specimens are Lepidoptera (butterflies and moths) and the collection is rich in both scientific and social history, with specimens collected by Alfred Russel Wallace, Herbert Druce, and G.C. Champion (Smith, 1986). The main collection also contains material associated with naturalist Henry Walter Bates. According to archival records in the OUMNH, the collection also contains material that once formed part of Bates' personal collection, and made its way to the museum via Frederick DuCane Godman and Osbert Salvin. While records in the Hope library indicate that the Godman-Salvin collection did indeed contain part of Bates' personal collection, this material was not immediately recognisable due to a lack of literature on how to identify Bates' personal labelling system. Examination and comparison of labels in Oxford's collection with Godman-Salvin material in the Natural History Museum, London, have now put the specimens under a new light. This includes material that was collected by Bates, but also material that was in his possession and was used to describe new species of Nymphalidae.

Bates' Collections

Born in Leicester in 1825, Bates left school at the age of 13 to carry on in his father's and grandfather's footsteps by starting an apprenticeship with a hosiery manufacturer. He worked 13-hour days and spent the evenings studying Latin, Greek, and French. During his free time, he collected insects with his brother Frederick in the nearby Bradgate Park. Bates studied in the library of the Leicester Mechanics' Institute. It was here that he met Alfred Russel Wallace, who had just started as an assistant teacher at the Collegiate School. The two men found that they shared a love of the natural world. Wallace was originally a botanist, but Bates introduced him to the field of entomology, and it wasn't long before the two men were planning a joint expedition to the Amazon, where they arrived in 1848. The expedition was funded almost entirely through the sale of specimens that they collected while there. Wallace returned to England after four years, but Bates spent a further seven years in the Amazon. When he finally returned to England in 1859, he had amassed a collection of over 14,000 species. 8,000 of these were new to science. (See Moon, 1976 for an extensive biography of Bates' life).

The larger portion of Bates' collections gradually

passed into private hands. He sent several consignments to his dealer, Samuel Stevens, while in the Amazon (Stevens, 1849), and they were subsequently sold on to private collectors. Unfortunately, many of Bates' specimens met an all-too-common fate in Victorian entomology practices, namely that many of the private collectors purchasing his specimens then removed his careful labelling to add their own labelling system, a practice that Bates himself was highly critical of (Moon, 1976).

Bates was also critical of what he considered to be 'stamp-collecting' among entomologists. He argued that naturalists should adopt an interpretive attitude to science while still using hard data. In a letter to Joseph Hooker dated March 19, 1861, he remarks:

"I know you are one of the very few who has striven against much opposition to elevate natural history into the rank of an inductive science. It certainly has not been one hitherto, but merely the observation and cataloguing of facts. An immense multitude of curious, isolated facts, accumulated; but they are unfruitful, simply because of the foregone and illogical conclusion that species are absolute and immutable". (Bates, 1861)

The Bates material in the Oxford University Museum's Lepidoptera collections is assimilated into the main historical collection, housed in 149 wooden cabinets. This collection comprises most of the historical butterfly material in the museum, and is taxonomically arranged.

Because much of the material was scattered through dealers and his original labels were sometimes removed, it is impossible to quantify just how much material in the collections was originally associated with Bates. What can be quantified is traceable through archival documents in the Hope Entomology Library at OUMNH and examination of specimen labels.

Most of the material was sold by Bates directly to John Obadiah Westwood, Hope Professor of Zoology from 1861 to 1892, who prior to this was conservator for the Entomology collections at Oxford University Museum (Smith, 1986). A fine collection of diurnal Lepidoptera was purchased from Bates in 1859 and labelled by Westwood, simply with the information 'Amazons, Bates'. This purchase included a rare example of a moth from the family Urodidae, complete with its net cocoon. A further batch of butterflies (mostly Erycinidae, now classed under the modern name Riodinidae) was purchased in 1860 and is labelled 'Amazons, Bates, 1860', also in Westwood's hand (Bates, 1860) (Figure 1). Bates was fond of this group of diurnal butterflies, and one of his Amazon notebooks, which is now housed at the Natural History Museum, London, is almost completely devoted to this group. One of the specimens in the Oxford collection is notable as a probable candidate for a specimen mentioned in his second notebook. On one page of this he notes: "306-310 inclusion applied to 4 new additional species [for] monograph of Erycinidae." (Bates, 1851 - 1859) The specimen in the Oxford collection bears the number

Figure 1. Letter from H. W. Bates to J. O. Westwood with attached invoice and a corresponding specimen from the Oxford collections. Photo by G. Allnatt © Copyright Oxford University Museum of Natural History.

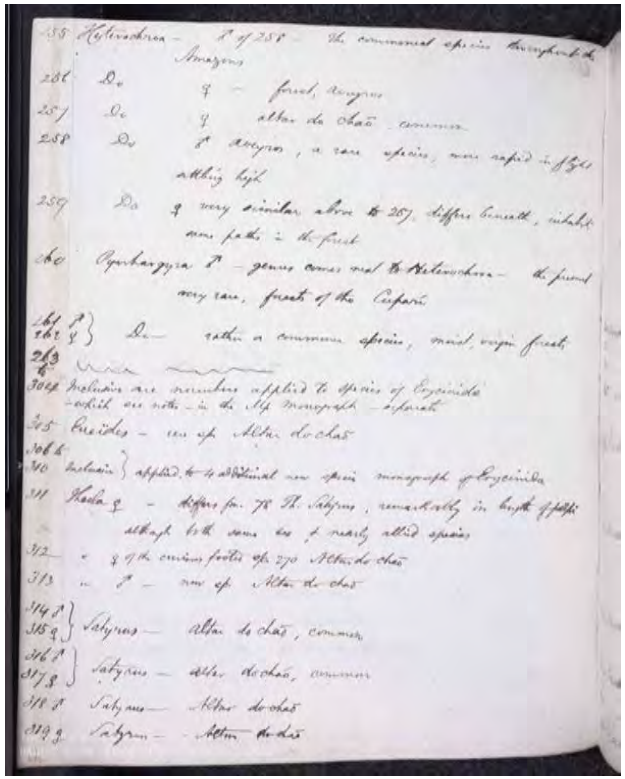


Figure 2a-c. a) Specimen that may correspond with numbers in H. W. Bates' original field notebooks. Photo of specimen by G. Allnatt Copyright © Oxford University Museum of Natural History. b-c) Notebook pages. The third specimen down from the left of the page of Bates' watercolours corresponds with the specimen in 2a. Pages courtesy Natural History Museum, London.

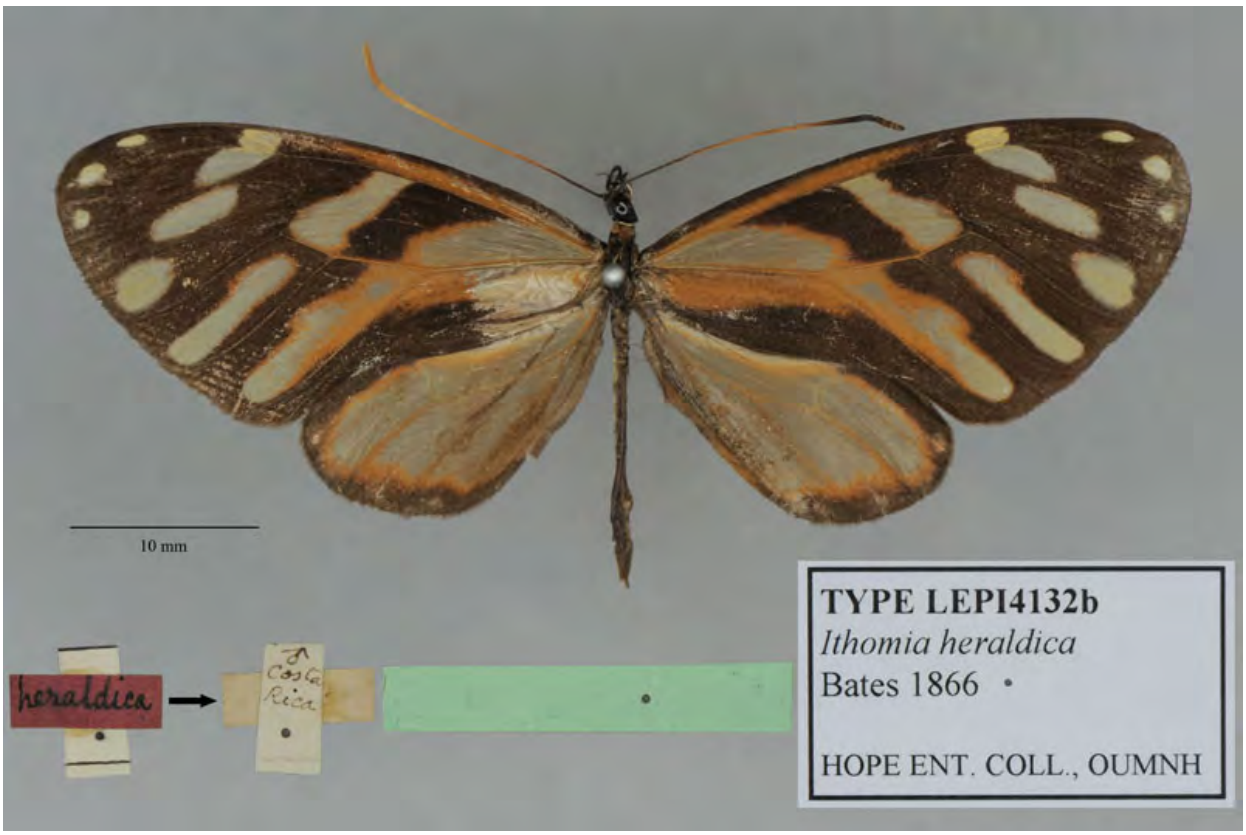
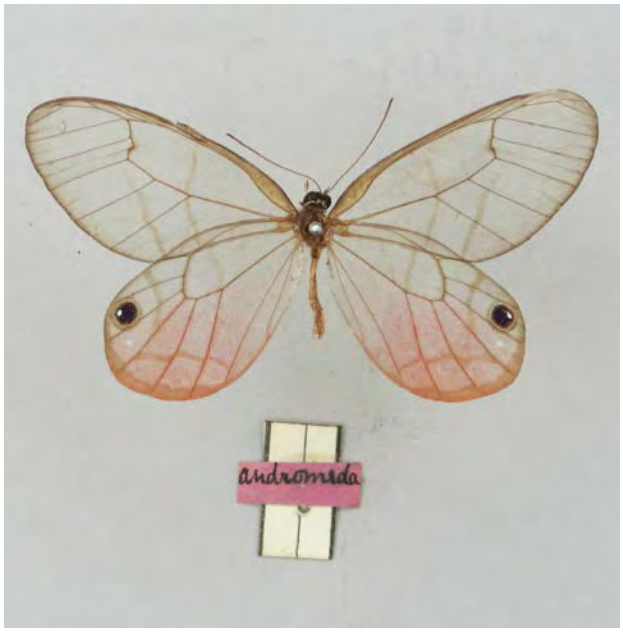
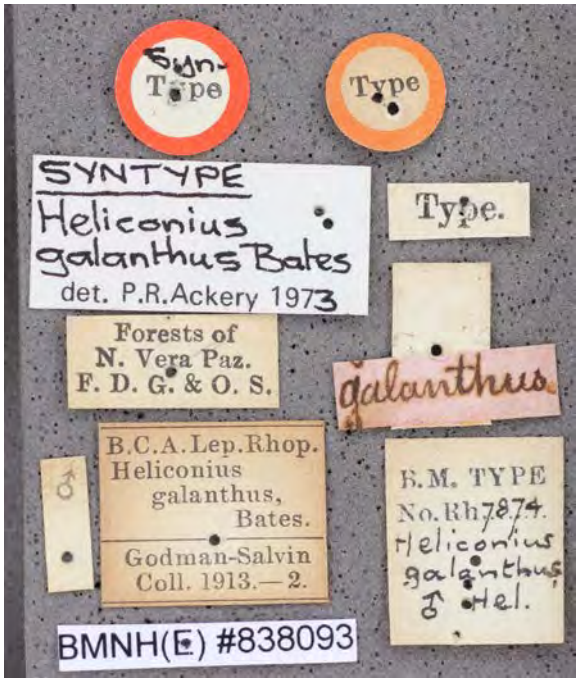


Figure 3: Syntype of Ithomia heraldica Bates, 1866 (specimen number: OXFUM-LEPI4132b), showing labelling consistent with the Godman-Salvin collection. Photo by Katherine Child © Copyright Oxford University Museum of Natural History.





Figures 4 and 5: Label from the Godman Salvin collection, Natural History Museum, London (BMNH #838093), and label from the OUMNH collection both showing the tell-tale pink strip identifying them as Bates specimens in Godman-Salvin's collection. Figure 4 courtesy and © Copyright The Natural History Museum, London. Figure 5 photographed by G. Allnatt and © Copyright Oxford University Museum of Natural History.

'310' and seems to match the watercolours in Bates' notebook, although it is not a new species (Figure 2a-c).

In 1882, Bates decided to concentrate on Coleoptera and sold his personal collection of butterflies to the taxonomists Frederick DuCane Godman and Osbert Salvin, who subsequently presented a portion of them to the British Museum (Boucard, 1892). The second half of the Godman-Salvin collection was presented to Oxford University Museum in 1896, four years after Bates' death (Smith, 1986), and is now incorporated into the main historical Lepidoptera collections. This material once formed part of Bates' personal study collection (Ackery and Goodger, 2002).

Much of this material contains Bates' original data (Ackery, 2015) in which the locality where the specimen was collected is carefully documented on the recto side of a rectangular label, and the species name is written on a pink or red strip on the verso side. Bates also recorded the sex of the insect on the recto side (see Figure 3). The majority of traceable Bates material in the collection comes from the Godman-Salvin collection, and is recognizable by this labelling. This was confirmed when comparing Oxford specimens with specimens from the collections at the Natural History Museum, London (see Figures 4 and 5). 80 specimens once belonging to Bates' personal collection have now been identified (see Appendix for a full list).

It is important to note that not all of the specimens with this labelling were collected in the field by Bates. Some of the material would have been specimens he acquired from other collectors and naturalists. For instance, one of the Bates specimens identified is a Papilio butterfly, Papilio neptunus (Guérin-Méneville, 1840), from Borneo (Figure 6). Bates exchanged specimens with Alfred Russel Wallace upon his return to England (Wallace, 1860), and Papilionidae were one of Wallace's specialisms (Wallace, 1865). It is possible that this Bornean specimen could have come from an exchange with Wallace.

Figure 6. Papilio neptunus Linnaeus, 1758 (now placed in the genus Losaria) from Borneo. Photo by G. Allnatt.

After examination of the Godman-Salvin material, six syntypes described in Bates' paper New Species of Butterflies from Guatemala and Panama, published in the Entomologist's Monthly Magazine 1864-1866, were identified and catalogued (see Table 1 and Figure 3). These all belong to the family Nymphalidae.

Also within the collections are specimens with the label 'Bates, Venezuela, 1873'. Westwood's records in the Hope library indicate that this is possibly material from W. C. Hewitson or W. W. Saunders, as purchases from them correspond with this date (Westwood, 1873). However, there is no way to prove this, and the labels are of dubious origin because the species do not correspond with the geographical range on the label.

It is entirely possible that there is far more Bates material in the collection than is labelled, as much material passed through the hands of private

Table 1: Syntypes in the Oxford University Museum from the Godman-Salvin collection.
Heliconius galanthus Bates, 1864 Ent. mon. Mag. 1 (3): 58, TL: Guatemala, ♂ from Godman-Salvin collection. SYNTYPE: LEPI4130. Acquired in 1896.
Dircenna xenos (Bates, 1866) Ent. mon. Mag. 3 (27): 50, TL: Costa Rica, ♂ from Godman-Salvin collection. SYNTYPE: LEPI4133. Acquired in 1896.
Amphirene superba Bates, 1864 Ent. mon. Mag. 1 (7): 161, TL: Guatemala, ♂ from Godman-Salvin collection. SYNTYPE: LEPI4131. Acquired in 1896.
Ithomia heraldica Bates, 1866 Ent. mon. Mag. 3 (27): 51, TL: Costa Rica, ♂ from Godman-Salvin collection. SYNTYPE: LEPI4132a. Acquired in 1896.
Ithomia heraldica Bates, 1866 Ent. mon. Mag. 3 (27): 51, TL: Costa Rica, ♂ from Godman-Salvin collection. SYNTYPES: LEPI4132b. Acquired in 1896.
Heterochroa melanthe Bates, 1864 Ent. mon. Mag. 1 (6): 129, TL: Guatemala, ♂ from Godman Salvin collection. SYNTYPE: LEPI. Acquired in 1896.

collectors and dealers, but without a label this would be guesswork at best.

Conclusion

After examination of the Oxford University Museum specimens I have concluded that a total of 370 specimens collected or acquired by Bates are present in the collection. Of these, 80 are from the Godman-Salvin collection and form part of Bates' once personal butterfly collection.

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Appendix. List of Bates specimens in the OUMNH from the Godman-Salvin collection

Family	Locality	Genus	Species	Author	No. of specimens
Papilionidae	Guatamela, Polochic Valley	Eurytides	thymbraeus	Boisduval, 1836	1
Papilionidae	West Coast, Guatemala	Battus	polydamas	(Linnaeus, 1758)	1
Papilionidae	Bogota	Papilio	polyxenes americanus	Kollar, 1850	1
Nymphalidae	Ecuador	Heliconius	hierax	Hewitson, 1869	1
Nymphalidae	Unknown	Heliconius	sara	(Fabricius, 1793)	1
Nymphalidae	Bogota	Heliconius	hydara guarica	Reakirt, 1868	1
Nymphalidae	Para	Eueides	isabella	(Stoll, 1781)	1
Nymphalidae	Guatemala interior	Danadus	archippus	(Fabricius, 1793)	1
Nymphalidae	Unknown	Danadus	cleothera	Godart, 1819	1
Nymphalidae	Unknown	Danadus	hermippus	Felder & Felder, 1865	1
Nymphalidae	Ega	Melinaea	mnasias lucifer	Bates, 1862	1
Nymphalidae	Costa Rica	Ithomia	xenos	(Bates, 1866)	3
Nymphalidae	Costa Rica	Ithomia	heraldica	Bates, 1866	2
Nymphalidae	Unknown	Ithomia	dorilla	Bates, 1864	1
Nymphalidae	Costa Rica/Guat.	Dircenna	klugii	(Geyer & Hübner, 1837)	2
Nymphalidae	Bogota	Taygetis	chrysogona	Doubleday, [1849]	1
Nymphalidae	Unknown	Cithaerias	pireta	(Stoll, [1780])	2
Nymphalidae	Bogota	Haetera	piera	(Linnaeus, 1758)	1
Nymphalidae	Bahia	Haetera	piera	(Linnaeus, 1758)	1
Nymphalidae	Para	Pierella	lena	(Linnaeus, 1767)	1
Nymphalidae	Para	Antirrhaea	philoctetes	(Linnaeus, 1758)	1
Hesperiidae	Para	Astraptes	fulgerator	(Walch, 1775)	1
Hesperiidae	Pebas, Amazon	Astraptes	fulgerator	(Walch, 1775)	1
Hesperiidae	Guatemala	Astraptes	anaphus	(Cramer, [1777])	1
Nymphalidae	Rio Grande	Morpho	catenarius	Perry, 1811	1
Nymphalidae	Panama	Dasyophthalma	creusa	Hübner, 1822-1826	1
Nymphalidae	Florida	Agraulis	vanillae	(Linnaeus, 1758)	1
Nymphalidae	Panama	Dione	juno	(Cramer, [1779])	1
Nymphalidae	Guatemala, Table land	Dione	moneta	(Cramer, [1779])	1
Nymphalidae	Guatemala, Polochic Valley	Dione	moneta	(Cramer, [1779])	1
Nymphalidae	Guatemala, Polochic Valley	Metamorpha	superba	(Bates 1864)	1
Nymphalidae	Guatemala	Metamorpha	epaphus	(Latreille, 1811)	1
Nymphalidae	Guatemala, Polochic Valley	Metamorpha	epaphus	(Latreille, 1811)	1
Nymphalidae	"Venezuela"	Metamorpha	epaphus	(Latreille, 1811)	1
Nymphalidae	Bogota	Nica	flavilla canthara	(Doubleday, 1849)	1

Nymphalidae	Guatemala, Central Valleys	Epiphele	adrasta	Hewitson, 1861	1
Nymphalidae	Bogota	Epiphele	ibilis	C. & R. Felder, 1861	1
Nymphalidae	South Peru	Perisama	calamis	(Hewitson, 1869)	1
Nymphalidae	Unknown	Euncia	cuvierii	(Godart, 1819)	1
Nymphalidae	Ega	Euncia	mygdonia	(Godart, [1824])	1
Nymphalidae	S. Paulo	Eunica	orphise	(Cramer, [1775])	2
Nymphalidae	Tunantais, Amazon	Eunica	clytia	(Hewitson, 1852)	1
Nymphalidae	S. Paulo	Eunica	veronica	Bates, 1864	1
Nymphalidae	Mexico	Eunica	amycla	(Godart, [1824])	1
Nymphalidae	Ega	Pyrrhogyra	crameri	Aurivillius, 1882	1
Nymphalidae	Ecuador	Pyrrhogyra	edocla	(Doubleday, [1848])	1
Nymphalidae	Guatemala interior	Didonis	aganica	Boisduval	1
Nymphalidae	Pebas, Amazon	Panacea	divalis	(Bates, 1868)	1
Nymphalidae	Ega	Marpesia	berania	(Hewitson, 1852)	2
Nymphalidae	Costa Rica	Marpesia	marcella	(C. & R. Felder, 1861)	2
Nymphalidae	Ega, Amazon	Marpesia	zerynthia	Hübner, [1823]	1
Nymphalidae	Guatemala interior	Smyrna	karwinskii	Geyer, [1833]	1
Nymphalidae	Table land, Guatemala	Diaethria	pandama	(Doubleday, [1848])	1
Nymphalidae	Guatemala	Callicore	tolima guatemalena	(Bates 1866)	1
Nymphalidae	Guatemala	Diaethria	astala	(Guérin-Méneville, [1844])	1
Nymphalidae	Guatemala	Adelpha	lycorias melanthe	(Bates 1864)	1
Nymphalidae	St. Domingo	Anaea	troglodyta	(Fabricius, 1775)	1
Nymphalidae	West Indies	Anaea	troglodyta	(Fabricius, 1775)	1
Nymphalidae	Bogota	Fountainea	nessus	(Latreille, [1813])	1
Nymphalidae	Guatemala, Central Valleys	Anaea	aidea	(Guérin-Meneville, 1844)	1
Nymphalidae	Guatemala	Anaea	aidea	(Guérin-Meneville, 1844)	1
Nymphalidae	Bogota	Anaea	andria	Scudder, 1875	1
Nymphalidae	Para	Zaretis	isodora	(Cramer, [1779])	1
Nymphalidae	Guatemala	Doxocopa	laure acca	(Felder, 1866)	1
Nymphalidae	Guatemala, Polochic Valley	Doxocopa	laure acca	(Felder, 1866)	1
Papilionidae	Panama	Eurytides	telesilaus	(Felder, 1864)	1
Papilionidae	New Granada	Eurytides	euryleon	(Hewitson, 1855)	1
Papilionidae	India	Papilio	paris	Linnaeus, 1758	1
Pieridae	Guatemala, interior	Leptophobia	aripa	(Boisduval, 1836)	1

Food management in museums and historic houses as part of an IPM programme

Suzanne Ryder

Department of Life Sciences, Insects Division, Darwin Centre - room 315, The Natural History Museum, Cromwell Road, London, SW7 5BD, UK

email: s.ryder@nhm.ac.uk

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Abstract

Managing food is an essential consideration when looking to avoid pests. As museums and cultural heritage sites are populated with people, the accommodation, and often provision, of food is necessary. There is very little in the literature directly dealing with food management in the context of museums and heritage venues (SPNHC, 2014), although there is a lot of relevant literature from the food industry in the context of food storage, processing, and environmental health, from which we can extract some useful information (Rentokil, 2016). This article will outline the Integrated Pest Management (IPM) risks associated with food management, and suggest some measures that can be put in place to mitigate the problems within museums and other cultural institutions.

Keywords: IPM, Integrated Pest Management, pests, food management, housekeeping, rodents, insects, birds

The risk posed to collections by food

The biggest risk posed to collections by food is poor management of both the food and food waste, which will attract pests to the buildings. Rodents will shred valuable paper items for nesting materials; they will gnaw on irreplaceable objects, such as antique furniture, to maintain their teeth, and their urine will contaminate any unprotected food or collections. Insect pests will destroy many organic materials, such as fur, feathers, skins, insects, dried plants, and wool textiles. They will eat these materials, which are found throughout collections. Insect pests will thrive in the nests of birds, so keeping the numbers of birds to a minimum will also reduce the insect pest population. Birds will also damage many cultural building with their guano. In addition, rodents and birds can also carry bacteria and viruses that pose a health risk to humans. Unmanaged problems with rodents can lead to serious damage to the reputation of a museum or cultural heritage site, and would prevent institutions holding popular events, such as 'Dinosnores' (Figure 1), which is an after-hours sleepover event for families hosted by the Natural History Museum, London (NHM).

Figure 1. Dinosnores late events at the NHM risk unwanted encounters with mice and consequent reputational damage. Image © Natural History Museum, London, UK.

The reputational and, ultimately, financial impact of pests can be extremely detrimental to museum business, e.g. the National Gallery incident (Shakespeare, 2015). Food and drink spilt directly onto an object will cause damage; this risk can easily be eliminated by not permitting food and drink into collections areas and covering or separating exhibits from the public. It is essential to understand that cleaning is an important part of IPM, to reduce food sources available for pests (Querner, 2015). Food residues will attract pests.

To effectively contribute to pest control for cultural property, we must work to formulate a 'most good with least harm' action (Strang, 2012). The basic principles of IPM emphasise best practise in conservation based on understanding the biology of the pests, and aim to minimise the use of pesticides. Key behavioural changes can reduce the risk of pest activity significantly. Within a museum or cultural heritage property open to the public there are five key areas:

Staff

Staff will need to eat and take regular breaks, and if they eat at their desks it is difficult to manage the food risk. There are a few measures that can be put in place as part of an IPM programme. The policy and procedure should be:

- Prohibit food and drinks in collection areas.
- Do not allow eating at desks. Where possible, provide designated eating areas, which can be more regularly and efficiently cleaned. This may be met with resistance from staff and can be difficult to implement, but by educating staff as to the risks posed by pests to the collections - and to their health - it can be introduced, and with time will become embedded into staff behaviour.
- Provide only communal bins with lids. This means personal waste bins will not get missed on a daily emptying schedule, leaving rotting food waste for long periods of time. Communal bins could be emptied more regularly, perhaps twice a day or once at the end of the day, so no food waste is left overnight. Lids are essential to reduce the attraction to pests. Regularly-changed bin liners should be used to prevent build-up of food residues inside the bins.
- Provide or encourage the use of sealed plastic containers for personal food storage, e.g. biscuits, fruit, sandwiches, etc. (fig. 2).
- Encourage staff to use the in-house restaurant or staff canteen, where provided, with discounts if possible. This will help to contain the movement and storage of food around the building.
- Provide staff with mugs that have lids, to reduce spillages (Figure 2).

Figure 2. Standard items provided free to NHM Staff to control food residues: insulated cup with lid, and food storage boxes. Image © Natural History Museum, London, UK.

Public & staff restaurants/canteens

Food provision for the public is regulated for human health reasons, but we can use this to our advantage, as IPM and human health work towards the same end within the setting of museum food outlets. Restaurants and canteens need to be regulated to British health and safety and environmental hygiene law, following the Food Standards Act 1999. There should therefore be a high level of cleanliness and tidiness with regard to food preparation, storage, and waste management. However, it is useful for the facilities manager and or the IPM coordinator to include these areas on their regular tours and inspections of a site. It is also important to manage and monitor the storage and delivery of food.

Functions/events

Functions are increasingly important for income generation, accessibility, and promotion of a museum. However, these 'out of hours' events, or events involving food being served in spaces which were not designed or constructed for that purpose, can pose a considerable risk to the collections. This is because they are often delivered by external caterers, security, and cleaning staff. The small team of internal functions staff members will manage these and run the event, but they will be the only people on site with a good knowledge of IPM and the potential risks such events can pose. Measures should be put in place to mitigate these risks:

- A robust accreditation process of suppliers, which

should include a section on IPM awareness, not only for caterers but for all companies bringing crew on site. During the accreditation process, ask that IPM procedures are added to their staff handbook, to be read and signed by each staff member.

- Restrict areas where food and drink are allowed, or segregate areas with vulnerable objects.
- Restrict the options of food and drinks available, such as red wine, to prevent staining of building materials or objects if spilt.
- Clean the venue immediately after the event. Never leave it until the morning. The additional cost of cleaning staff can be incurred by the caterers if built into their contract.
- Ensure the waste is properly removed from the site after the event.
- Housekeeping staff should be working throughout the event to clear and remove any unwanted food, empty glasses, and plates.
- All agency staff should be given an IPM briefing before starting.
- The events staff need to be provided with a designated rest room for breaks and for eating in. This space also needs to be cleaned and all waste removed at the end of the event.
- If an accident or spillage has occurred, this should be reported to the appropriate facilities manager or conservator immediately, or first thing the next morning if these people are not available.

The public

This group are more difficult to restrict or manage, as we invite these visitors into our space, but there are some measures that can implemented to assist IPM:

- Place signage in public areas to make the public aware of the vulnerability of the objects that make up the exhibits, including practical tips on how they could modify their behaviour to protect the collections.
- Provide picnic areas to contain the food consumption, and provide increased housekeeping within these areas to manage the food waste.
- Housekeeping teams should patrol the public areas at all times, allowing them to respond to cleaning issues as they arise, rather than leaving them until the evening or the next morning to be dealt with.
- Public areas should be cleaned at the end of the day, rather than in the morning, to reduce the risk of attracting rodents overnight.
- Empower front of house staff to approach daytime visitors seen eating and to explain the risks, and direct visitors to designated eating areas.

Outside the building, gardens and surrounding space: What happens in the grounds of a building and the surrounding areas will have a direct impact on the IPM within your building. A few suggested procedures that can reduce pest ingress are:

- Fill holes in walls and check ventilation grills to ensure that they are not broken or loose.
- Make sure sewers are securely closed so that they do not allow the entry of rodents into the building. This is also an essential Estates management task, for health and safety reasons.
- Collect all discarded litter and waste.
- Make sure that all waste is properly sealed, stored, and collected regularly, so that it does not attract pests. Ideally, the waste should not be stored directly against the building. If it can be placed some distance from the building, this will further reduce the pest risk.
- Discourage feeding of birds by staff and visitors near the building, as the residual bird food will encourage rodents.
- Regular patrols by ground staff with a good knowledge of IPM can help to keep the outside space clean and well maintained.

Conclusion

Pests seek habitats that satisfy basic needs such as food, water, and shelter. Successful IPM depends on staff working together to establish an environment that limits harbourage areas, points of entry, and conditions that attract pests (UCLA, 2006). All catering and food handling for public, staff, and schools on the site must be to an agreed high standard of hygiene to minimise risks from insects, rodents, and birds.

There are simple, practical measures that, with a little IPM awareness training and implementation of best practices, can have an enormous impact on mitigating the risk of pests. The measures described in this article can be met will little, if any, financial implications. The importance of cleaning has been highlighted, but the level of cleaning does not necessarily have to be increased; it just needs to be more focused in areas where there is likely to be high footfall and food residue (e.g. canteens, common rooms). It is important to work

with the housekeeping staff and the contract managers to ensure that that the service provided suits the needs of the institution.

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Where are they now? The records and collections of James Needham (1849 - 1913), amateur mycologist and bryologist of Hebden Bridge, Yorkshire. Locating his legacy and resources for further study

Richard A. Baker

School of Biology, University of Leeds, Leeds, LS2 9JT, UK

email: R.A.Baker@leeds.ac.uk

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Abstract

An account of James Needham (1849 - 1913) of Hebden Bridge, his records and herbarium collections in British museums, botanical gardens, and archives. Biographical details are given of Needham and his associates.

Keywords: James Needham, fungi, mosses, Calderdale, collections, biography

Introduction

On 17 December 1957, a letter was sent from the Royal Botanic Gardens, Kew, to Hebden Bridge Literary and Scientific Society (HBLSS), to say that Kew would be glad to accept their offer to donate part of James Needham's herbarium. Three months later, on 19 March 1958, the Honorary Librarian of HBLSS, Mr. E. W. Watson, wrote to Dr. G. Taylor, then Director at Kew, to inform him that Needham's herbarium was on its way. It was sent in 'one large parcel by registered post, and a larger carton by rail to Kew Bridge Station' (Clark, 2016a). This was around the time that the Natural History Section of HBLSS was ceasing operations. The collection, comprising specimens of fungi, was discovered in the HBLSS archive by Roy Watling in 1956.

Kew, however, is not the only institution to house material collected by James Needham. There are important records and specimens at the Leeds Discovery Centre (part of Leeds City Museum), and several other places also. This paper is an attempt to document the collections and records of James Needham.

Needham was one of many amateur botanists from Lancashire and Yorkshire, many of whom were concentrated in southwest Yorkshire in the late 19th and early 20th centuries. Although there have been several short articles about him (British Bryological Society, 2017) and his herbarium at Kew (including Palmer 1957, Watling 1958), and obituaries (e.g. Crossland, 1913), his collections have not been documented together. Needham demonstrates what can be achieved by hard work and application, and he has proved to be an interesting and important bryologist and mycologist within the artisan group, and a distinguished collector.

Brief summary of Needham's life and work in natural history

James (also called 'Jimmy' or 'Jimmie') Needham was born in Hebden Bridge, Yorkshire, on 19 March 1849. He was the eldest of 10 children of Thomas (1829 - 1885) and Mary (nee Greenwood). In 1871, he married Mary Ann Parker (1851 - 1889), and in 1899 married again, this time to Amelia Jones (1851/2 - 1905). He was a modest and unassuming

man, and an excellent collector and lister, who would work at his hobby in all the available hours, day and night.

Like his father, he was an iron-moulder by trade, apprenticed to the Hartley and Crabtree foundry in Halifax, and it was only in his spare time that he was able to study botany. Needham took up these studies in his mid-thirties as a result of a botanical ramble in Hardcastle Crags with members of the local co-operative movement. His special collecting areas became those around Hebden Bridge, Pecket Well, and Hardcastle Crags, although many of his specimens indicate that he collected more widely. He knew 'every corner of Hebden Bridge' (Blockeel, 1981). His early interests were in mosses, and later in fungi.

In the late 1880s he was introduced to fungi by Charles Crossland, a prosperous Halifax butcher, who became a collaborator and close friend. Needham proved to be "an excellent and most helpful guide" (Crossland, 1913) as well an avid collector. He had a "keen eye, an alert mind and a retentive memory", and expressed himself with "an amusing frankness in his native dialect" (Crossland, 1913). From this period, he became an enthusiastic mycologist. Crossland and Needham published together (Crossland & Needham, 1904), and Crossland helped Needham in his hobby by providing him with books, a microscope, and introduced him to other mycologists. Needham also became a close friend of Henry T. Soppitt, and they worked together on rust fungi. Needham died on 14 July 1913 and was buried at Birchcliffe Baptist Chapel (now the Birchcliffe Centre). Obituaries included a lengthy local one in the Hebden Bridge Times, dated July 18, 1913. There are also references to him in The Naturalist (1957 pp. 89 - 92, and 1961 pp. 56 - 57).

Writing about his mycological work, Blackwell (1961) noted that Needham had "a flair for collecting", and after a hard day's work of 10 or 12 hours he would "fettle hisself up a bit" and would go to the woods and moors, observing and collecting mosses and fungi. He acted as leader of numerous parties and for well-known bryologists and mycologists. Blackwell quotes an obituary in the local newspaper of July 1913, "a somewhat diminutive but withal wiry figure with an intelligent and rather careworn face, bright eyes, high forehead and dark hair turned almost white in places". Watling (1982) describes his abilities as a collector, and notes that "his opinions were always valued" and that it was "people like Needham on whom professionals like Massee and Cooke (Mordecai Cubbitt Cooke 1825 - 1914) depended". He describes how a group of men made up a "Yorkshire mycological trio: the professional (Massee), the middle-class naturalist (Crossland) and the amateur working class field naturalist (James Needham)" (Ibid.). Watling (1966) gives a useful historical account of the fungus and lichen flora of the Halifax area, which refers briefly to Needham.

Needham was a member of the Yorkshire Naturalist Union (YNU) Mycological Section, a founder member of the British Mycological Society, and an honorary member of both the Hebden Bridge Literary and Scientific Society (1907) and the Halifax Scientific Society (1911). In the latter society, his citation included the words 'in recognition of his services in investigating the 'Fungus Flora' of the district' (Halifax Scientific Society, 1911).

The Hebden Bridge Literary and Scientific Society (HBLSS) was formed in 1905, and in 1906 created a Natural History Section. It has been described as a 'locus classicus' for British mycology (Ainsworth, 1996). Needham was recorder for 'fungi and hepatics' between 1907 and 1911, although latterly he shared responsibilities for this work with William Nowell. Regarded as one of the founders of the main society and the founder of the Natural History Section of the HBLSS, Nowell became a specialist in tropical mycology (Baker, 2016). Society members at Hebden Bridge thought so highly of him that, following his death, the secretary was asked to write to the Yorkshire Naturalist Union suggesting that there might be a memorial to him: "a suitable form of memorial would be a scholarship at Leeds University in some Natural History Subject" (Hebden Bridge Literary and Scientific Society, 1913).

Authors interested in Needham's bryological work have not considered his collections in any detail. According to Blockeel (1981), "most of the new bryophyte records for the Flora of the Parish of Halifax were contributed by…James Needham", but he did not produce many scientific papers. Much of his work is recorded in local newspapers (Crossland, 1913) or as a co-author (Crossland and Needham, 1904). He also contributed fungal records to Crump and Crossland (1904), and found several species new to the British flora. *Gnomonia needhamii* Massee & Crossl. (now a synonym for *Klasterskya acuum* (Mouton) Petr.) was named after him, and was new to science (Yorkshire Naturalist Union, 1904). According to Blockeel (1981), his most important discovery in bryology was *Jubula hutchinsiae* (Hook.) Dumort (see also Slater, 1897). This rare bryophyte is named after the gifted Irish botanist Ellen Hutchins (1785 - 1815), who discovered it in western Ireland.

It is commonly called Hutchins' Hollywort. Needham first found it on 15 December 1896, in the Hebden Valley (first Yorkshire record. See Slater, 1897).

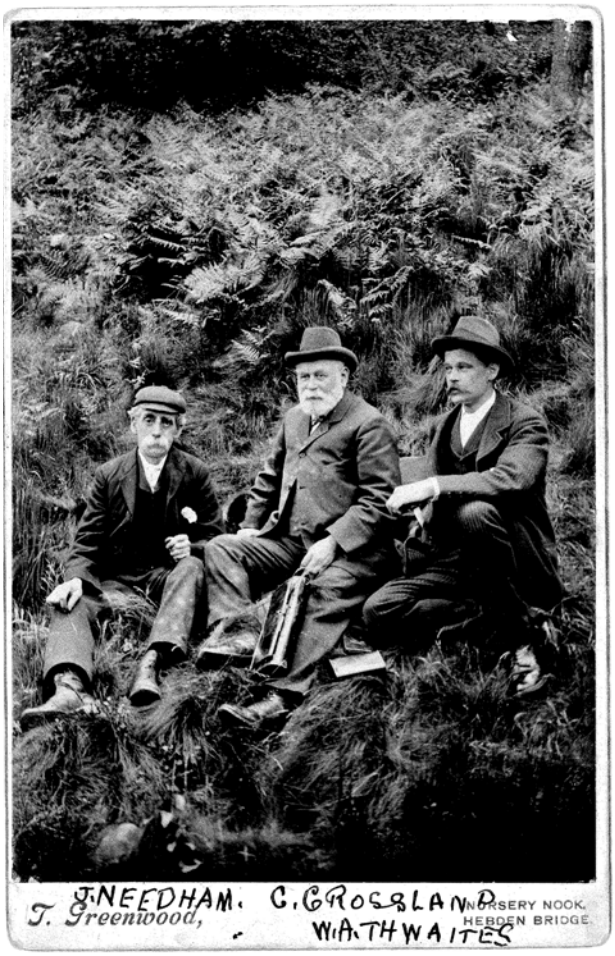

Figure 1. Group photograph in the field of (left to right) J. Needham, C. Crossland and W. A. Thwaites. The original is with the Needham papers at the Discovery Centre, Leeds. Permission to use and copyright ©Leeds Museums and Galleries. Acknowledgement to Rebecca Machin for help.

The collections

Needham's main collections are at Royal Botanic Gardens, Kew and Leeds Museums and Galleries. These, with others, are documented below. There may still be material in other towns and cities yet undiscovered and unrecorded.

Most herbarium collections are currently being electronically databased, but the work is not complete and lists therefore do not necessarily include all the specimens held by an institution. There are also revisions and changes in nomenclature, as well as some misidentifications, that have to be taken into account when detailed consideration is given to these collections. Palmer (1957), for example, working on Needham's collection of Gasteromycetes, wrote in his introductory general statement that, "The true identities of old records are often doubtful and we usually have to accept these names in good faith, although we may have secret doubts". Of the 23 Gasteromycetes in the collection, seven were correctly identified and 14 mis-determined, and some with heavy insect damage were discarded.

Further complications arise when the collections of one person are handed over to another person, institution, or collection, and may then be included under the new person's name. This is the case with Needham also. Needham's specimens can thus be found in the collections of C. Crossland and H. T. Soppitt at Huddesfield. One example of how complicated it can become is the herbarium of Rev. George Sowden, Vicar of Hebden Bridge and a keen ornithologist and botanist. This collection went to the Mechanics Institute, then to the Secondary Education Committee in Hebden Bridge, and for a time was in the hands of Needham, who rearranged, remounted, and classified it (700 specimens in 11 volumes). During this work, many rare specimens were found (Anon., 1910).

Needham's documentation was mainly in the form of lists and notes with no supplementary material, such as drawings and descriptions, and when specimens were examined by later workers, many were found to be infested by insect pests or damaged in other ways. Watling (1958) expressed disappointment that "Needham did not preserve all his boletoid material, as many rare species are listed in his notes".

1. Leeds Discovery Centre at Leeds Museums and Galleries (LES)

Needham's specimens and documents were transferred from Bankfield Museum, Halifax, to Leeds in 1990 (Norris, 1997). They are now at the Discovery Centre in Leeds.

The documents include an exercise book in which he wrote the account of 'A ramble over the Hills'; a brown packet containing lists of species collected; several 'Collection Research data coding forms (C)' (presumably the Bankfield Museum proforma) which list, on separate sheets, the ferns, flowering plants, mosses and hepatics in the collections, with names of associated collectors; typed lists of same from the Hebden Bridge Literary and Scientific Society; and a typed list entitled 'Needham Herbarium – Phanerogamia'. (see LEEDM.C.1990.1 - letters, notebooks etc.)

The herbarium sheets consist of:

30 sheets of ferns (mainly West Yorkshire), 1874 - 1913.

25 sheets of flowering plants (mainly West Yorkshire), 1874 - 1913.

145 sheets of Hepatics (England, Scotland, Ireland), some ex-herbarium of John Nowell, 1892 – 1913. These include nine associated peoples' names.

825 sheets of mosses (England and other countries including Ireland, France, and Italy), mainly 1884 – 1913, but a small number date back to 1847. These include 21 associated peoples' names, and "many members of The Moss Exchange Club".

There is also bryological material collected by Needham, which was in the University of Leeds Herbarium and is now at the Discovery Centre, Leeds.

See also: Hartley et al. (1987) and Norris (1997).

2. Hebden Bridge Literary and Scientific Society (HEB)

a. Scrapbook/Album (for details see Henderson, 1992).

This album was "Presented to Mr. Will Ashworth in token of respect by his friend James Needham, Ward End, Hebden Bridge", and dated October 1912 (Anon., n.d.).

Ashworth was a printer and publisher in Hebden Bridge in partnership with a Mr. Kershaw (Kershaw and Ashworth Ltd), and the premises were also the offices of the Hebden Bridge Times.

The scrapbook contains over 180 mosses, 20 liverworts, and 30 vascular plants (Henderson, 1992). It also includes around 30 pages of newspaper cuttings from The Halifax Courier, Hebden Bridge Times, etc., about Needham, as well as reports from the Hebden Bridge Times of rambles around Hebden Bridge, plus some obituaries of Needham. A copy of Crossland's obituary of Needham (1913) is included.

b. Four boxes containing small, transparent plastic envelopes with records and specimens of lichens, liverworts, mosses, and fungi presumed to be associated with Needham. The collection was sorted and re-packed into the transparent envelopes.

c. Note on James Needham by M. W. Sykes (Sykes, n.d.), entitled 'James Needham of Hebden Bridge 1849-1913', brief biographical note on Needham, and transcription of 'A ramble over the Hills' by James Needham, which is a description of a walk undertaken in the 1890s. A copy of this exists in Leeds Discovery Centre.

d. Natural History Catalogue (in the Hebden Bridge Local History Society Archive).

NHS2: Manuscript lists of mosses, manuscript list of records dated 1893, generic list of Musci and index, printed list of Phanerogamia.

NHS26: Letter dated 27 February 2004 that gives details of Needham collection, plus a copy of Henderson (1992).

3. Huddersfield - Tolson Memorial Museum Huddersfield (HDD)

There are 50 specimens at the museum collected solely by James Needham, or by him in collaboration with H. Pickles. 10 of these are fungi, six are mosses, and the remainder are vascular plants (Yeates, 2016). The fungi are part of the H. T. Soppitt collection, and the vascular plants are part of the C. Crossland botanical collection.

4. Royal Botanic Gardens (K)

A manuscript catalogue (11 pages) of James Needham's herbarium, entitled 'Catalogue of Fungi in Needham's Herbarium, Secondary School, Hebden Bridge, December 1910' (Clarke, 2016b), is held in the archives at Kew but lacks the detail of when and where the specimens were collected. See Anon. (1960), Palmer (1957), and Watling (1958, 1982).

115 Needham specimens are listed on the Mycology database at Kew ('Herbtrack'), some of which are ex-herbarium of C. Crossland. This might not represent all the material belonging to Needham to be found in this collection, as the digitisation is incomplete at present. All the specimens were collected between 1894 and 1912, and determined by Needham and others including C. Crossland., C. H. Andrews, J. Nannfield, and E. M. Wakefield. The collection includes some types: *Calonectria vermispora* Massee & Crossl., and *Peniophora crosslandii* Massee. The database gives little information on location and habitat.

The Kew mycological collection, discovered at Hebden Bridge in the HBLSS archives by Roy Watling in 1956 and handed over to Kew, is referred to by Watling (1982).

5. Amgueddfa Cymru - National Museum Wales (ACNMW)

There are six specimens listed in the database of ACNMW, all bryophytes (five mosses and one liverwort), which were collected from southwest Yorkshire (Hebden Bridge, Hardcastle Crags) by Needham between 1896 and 1904. Two have Crossland listed as first collector and Needham as the second, and four were purchased by the museum. They are listed as follows:

Sphagnum fallax (H. Klinggr.) H. Klinggr.
S. subnitens Russow & Warnstorf
Plagiobryum zieri (Hedw.) Lindb.
Racomitrium aciculare (Hedw.) Brid.
Philonotis fontana (Hedw.) Brid.
Jubula hutchinsiae (Hook.) Dumort).

Harrison (1985) lists 23 bryophytes in his catalogue.

6. Natural History Museum, London (BM)

There are 19 records of Bryophytes collected by Needham around the 1900 period at the Natural History Museum (NHM), from either midwest or southwest Yorkshire. However, since only around 10% of specimens at this institution are databased, it is likely that many more of Needham's lichens, mosses, and liverworts will be recorded in due course. There is one lichenicolous fungus on the database so far (*Tichothecium gemmiferum* (Taylor) Körb.), collected by Needham in Calderdale in 1903. This parasite has not been revised in recent years, and both the name of the host and the parasite may change when this has been carried out.

7. Bolton Museum (BON)

Bolton museum holds a total of 145 mosses and fungi specimens attributed to Needham, but has no correspondence (Stenhouse, 2016).

8. West Yorkshire Archives, Calderdale (based at Halifax Library)

There are a number of letters from James Needham to William Bunting Crump relating to botanical matters, written in the 1890s, within the West Yorkshire Archives (WYC:1830/7/1 (1895-1908) and WYC:1830/7/2 (1909-1912)).

Conclusion

James Needham was an important amateur botanist, and a prolific collector. This article has brought together information on his specimens and associated archival material for the first time. It demonstrates the diversity of his collections, and how they have been dispersed among different institutions. Judging by the amount and variety of material listed, including letters, lists, and note books, Needham and his collections deserve a more comprehensive study and evaluation than has yet been carried out.

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@OisinTheDeer: engagement and dialogue through a museum-based Twitter account

Jonathan D. Radley

Heritage and Culture Warwickshire, Market Hall Museum, Market Place, Warwick, Warwickshire, CV34 4SA, UK

email: jonradley@warwickshire.gov.uk

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Abstract

The microblogging platform Twitter has enjoyed widespread uptake by museums for its ease of use and proven efficacy as a dialogic social medium. Warwickshire Museum's account @OisinTheDeer is founded upon a popular exhibit: the skeleton of an extinct Irish Elk. This is one of a growing number of accounts based on museum mascots, giving their parent museums a 'voice' to facilitate informal dialogic communication with diverse audiences. @OisinTheDeer has proved to be an effective broadcasting tool, further embedding the Warwickshire Museum within the broader arena of museums, heritage organisations, and local communities.

Keywords: Twitter, social media, museums, engagement, dialogue

Introduction

In the wake of the Web 2.0 'revolution', the open-source Twitter microblogging platform has become an established and popular element of global communication, allowing 'instant' electronic dialogue within the 140-character constraint, via desk-top and mobile devices (Bik and Goldstein, 2013; Castillo et al., 2013; Gillen and Merchant, 2013). Twitter is enjoying increasing uptake by museums and science centres as they expand their provision beyond traditional, physical media (Kidd, 2011; Padilla-Mélendez and del Águila-Obra, 2013) and engage with agendas such as the 'Participatory Museum' (Simon, 2010) and 'Happy Museum' (Thompson et al., 2011). This has been driven by a shift towards more sustainable, community-supported futures, involving publics as active participants and contributors (Kelly, 2010; Simon, 2010; Black, 2011; Holdegaard and Klastrup, 2014). In this context, Twitter affords dialogue, facilitating enhanced museum visitor experience (e.g. see Charitonos, 2011). Web-based searches demonstrate numerous and diverse museum-based Twitter accounts globally, communicating formally and informally (e.g. see Espinós, 2014, 2015). Subject matter ranges from discipline-specific information to events, activities, and marketing (e.g. see Padilla-Mélendez and del Águila-Obra, 2013).

Twitter presents notable limitations and challenges. It requires access to digital technology and the internet, something that is by no means universal (e.g. see Office for National Statistics, 2015). Building up a following necessitates a time commitment. Twitter additionally involves vast rates of information flow (e.g. see Huang et al., 2010; Ediger et al., 2010), much of which is highly ephemeral. Through its decentralised character, Twitter messaging carries an issue of 'quality control', and the credibility of information-based tweets can be difficult to assess (Castillo et al., 2013). With special reference to museums, Twitter takes discourse, voice, and even collections into a new and largely unfamiliar public 'space' (Kidd, 2011).

@OisinTheDeer

Twitter's capabilities and potential mesh well with developing dialogic agendas within museums, notwithstanding limitations (see above). Supporting our developing community-facing approach, we (Warwickshire Museum based at the Market Hall Museum, Warwick; now part of Heritage & Culture Warwickshire (HCW)) established our Twitter account in May 2010. By that time, uptake of Twitter by museums was quite widespread; affording us the opportunity to assess what approach might work for us. Our investigations of museum-based Twitter accounts converged upon a growing number that were voiced 'through' museum objects, artefacts, and mascots. Many of these are official accounts, tweeting variously about life in museums and other heritage venues and/or natural science or human history interest (Mortimer et al., 2016), or (in some cases) specifically on events and activities.

Museum mascots on Twitter include: skeletons (frequently fossil or sub-fossil; e.g. @SUETheTrex), taxidermy (e.g. @Chelmsford_Bear), mummies (e.g. @KVMMUMMY), and even boats (@LoggieLogboat). We found these accounts particularly engaging, as they provide 'personalities' and informal 'voices' in an active, first-person style. We decided to establish our account on this basis, to communicate information relating to our collections, natural science, and human history interest in general; news relating to other parts of our organisation, museum events and activities, and local community events and interest. In effect, we wanted to use Twitter to expand our offer beyond museum buildings and opening hours, in terms of scope, temporal and spatial reach, and audience diversities, and to further promote dialogue with our users, peers, partners, and communities.

Whilst we were happy with the image of our service as a brand, we felt that an animated 'voice' would afford us greater opportunity for engagement than a more conventional, 'corporate' organisational account. Museums and other public-facing institutions with life science interests, collections, and exhibits have long utilised the positive emotional appeal of 'cute' and/or large and impressive animals, notably mammals, to engage with publics (e.g. see Driscoll, 1995; Gunnsthorsdottir, 2001; Small, 2012; Roberge, 2014; Mortimer et al., 2016). Capitalising upon the so-called 'Bambi effect' (Bach, 2015), we decided to base our Twitter account on one of our most iconic exhibits: the composite sub-fossil skeleton of an extinct Irish Elk (*Megaloceros giganteus* (Blumenbach)), collected from a peat bog in Limerick, Ireland in 1866, and acquired by the Warwickshire Natural History and Archaeological Society (Warwickshire Museum specimen WARMS-G12970). The skeleton, mounted on an iron frame (Figure 1), has been displayed at the Market Hall Museum, Warwick, for at least 100 years. In the mid-1970s, re-display of the Market Hall Museum's ground floor gallery involved installation of a low suspended ceiling and repositioning of the skeleton facing into the gallery, close to a blacked-out external window (Figure 1).

Figure 1. Irish Elk skeleton (Megaloceros giganteus (Blumenbach)). Warwickshire Museum specimen WARMS-G12970. This photograph was taken before 2010, showing the earlier configuration of the mounted skeleton, facing into the museum gallery.

Figure 2. Irish Elk skeleton 'looking out' over Warwick's market square from the Market Hall Museum, 2015.

In 2010, driven by our developing community-focused agenda, we removed the suspended ceiling, re-glazed the windows with clear glass, and rotated the mounted skeleton to 'look out' of the Market Hall Museum across Warwick's busy, public market

square (Figure 2). For our Twitter account, an in-house designer and volunteer were given a free hand in 'reinventing' the skeleton as a 'living' Irish Elk. They designed an appealing graphical illustration (Figure 3), representing the 'tweeting' public persona of our skeleton. This was met with universal approval and enthusiasm by museum staff, and was adopted. Digital copies were generated at several resolutions, allowing us to variously use them for web- and paper-based publicity.

Figure 3. Graphical representation of Irish Elk skeleton as @OisinTheDeer.

Our account is named @OisinTheDeer, and went live in May 2010. His name (Oisin, pronounced 'o-sheen') was selected through a public vote, and means 'young deer' in Gaelic. Thus established and animated, Oisin The Deer started tweeting. Twitter is highly adaptable, allowing broadcasting and re-broadcasting ('re-tweeting') of short texts, photos, and hyperlinks, targeted tweeting (embedding usernames within tweets), and direct messaging (e.g. see Kirilenko and Stepchenkova, 2014). Additionally, insertion of hashtags allows users to follow and remotely contribute to 'hash-tagged' events such as conferences and other mass-dialogues (e.g. see Desai et al., 2012; Shiffman, 2012; Mortimer et al., 2016).

As the principal 'voice' of Oisin, it took me a while to find my way around this new medium, gain confidence, and establish the tone. After a period of approximately 4 - 8 weeks, I felt that I had established a 'personality', setting a tweeting style that remains to this day. This voice was largely defined by me personally, commenting on day-to-day work and events within the Warwickshire Museum, and adding light-hearted, enthusiastic, and sometimes humorous commentary to linked stories, facts, and photos. Colleagues gave valuable feedback in the initial weeks and months, concerning voice, tone, and the nature and content of tweets. A follower-base soon started to grow, founded upon frequent tweets (very roughly 5 - 15 per day), retweets, and 'follows'.

The purpose of our account has stayed fundamentally constant over the six years of its existence, to date. It is normally active on a daily basis, tweeting about items of interest in the news and/or locally, museum-related issues, and our public activities and events in and beyond the museum buildings. @OisinTheDeer participates in hash-tagged events, which facilitate user-searching for specific events or topics. These include the annual #museummascot day when tweeting museum and heritage site mascots from around the world 'meet up', converse, and take questions from followers. Natural history collections-based tweets are promoted by currently popular weekly hash-tagged events including #MolluscMonday, #WormWednesday, and #FossilFriday (Mortimer et al., 2016). There is considerable interaction with other HCW accounts, notably @RuairiTheFawn (see below) and @OurWarwickshire; the latter represents HCW's new community website, 'Our Warwickshire'. Additionally, @OisinTheDeer has provided an additional 'voice' outside of the museum, augmenting the communication work of staff members attending conferences, other museums, heritage sites, and local community events.

@OisinTheDeer has currently (January 2017) attracted over 4000 followers. Follower numbers have started to level out, after initial rapid growth. We now log Twitter analytical data on a regular basis, and the success of the account has been underlined by follower numbers and volume of interaction, as indicated by 'profile visits' (number of times the profile page has been visited), 'impressions' (the number of people who have seen an individual tweet), 'mentions' (number of times the username has been mentioned in tweets) and other parameters presented on the Twitter analytics database (Figure 4). @OisinTheDeer has received several awards, not least 'Best Museum Mascot' in the annual Shorty Awards (Wikipedia contributors, 2017), 2013.

Among HCW's other Twitter accounts, @RuairiTheFawn (launched January 2014) is closely linked to @OisinTheDeer, and is managed by HCW's Learning and Community Engagement team to promote public events and activities. Ruairi

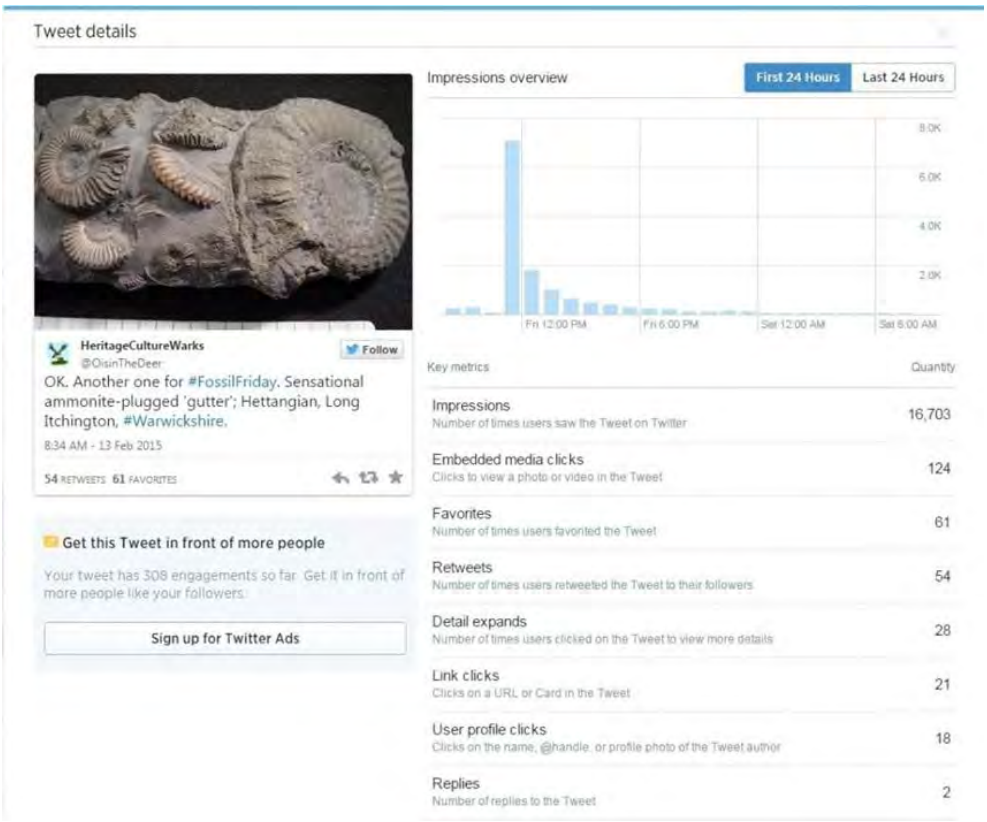

Figure 4. Twitter Analytics (screenshot): data relating to a single tweet from @OisinTheDeer.

The Fawn is promoted as Oisin's nephew; Ruairi similarly tweets in an animated, first-person fashion, engendering informal dialogue. His follower-base is rapidly growing; currently (January 2017) he has more than 1900 followers. Whereas the 'real' @OisinTheDeer is a skeleton of an extinct Irish Elk, his nephew, @RuairiTheFawn (see above) is represented by a plush toy moose. The 'real Ruairi' has proved extremely effective as a 'prop' for live-tweeting of photographs via mobile devices, from museum-based events and activities.

Our experience: what works

We (HCW) are part of Warwickshire County Council (WCC). Our Twitter accounts were founded upon formal application to WCC's social media board, which assesses the potential viability of proposed corporate accounts against criteria such as percieved popularity, and whether applicants might be better served by more traditional publicity methods. Once authorised, we were afforded a good degree of autonomy, framed by corporate guidelines, our experience of working in local authority and heritage environments, professionalism, and common sense.

From the outset, we envisaged our follower-base growing through combined provision of our own tweets, 'follows', and re-tweets. Advice from other account holders indicated that, ideally, we should be tweeting several times daily. @OisinTheDeer tweets in an active, positive, first-person voice, fostering engagement with followers and facilitating dialogue (e.g. see Marks, 2013). 'Cute' avatars clearly work well (Figure 3), potentially giving appeal to objects and specimens (e.g. skeletal remains and taxidermy) that might not be otherwise appreciated. Humour also assists in engagement, and we feel that it is important to occasionally tweet about quirky items and events that are relatively trivial, to keep our messages varied. Photographs are equally important, as are shortened links to external websites, for further information. Above all, we have found that short, eye-catching tweets are the most successful in terms of promoting potential re-tweets. From time to time, Oisin's standard graphical representation (Figure 3) is temporarily replaced by others in which he wears costumes, linked to specific events and anniversaries (Figure 5).

Initially, we tended to follow museums, museum mascots, heritage organisations and groups, and other organisations concerned with museum-based disciplines, natural science interests, and conservation. We have avoided following accounts with overtly political agendas; similarly, we apply a good degree of self-censorship (Marwick and Boyd,

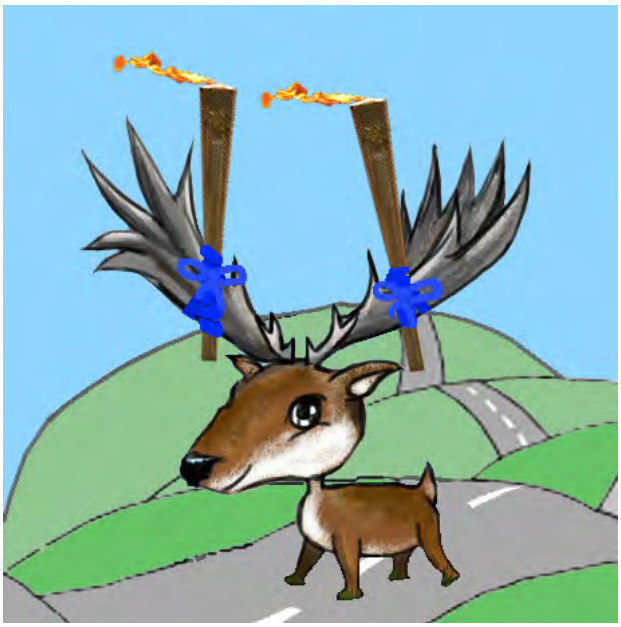

Figure 5. Graphical representation: @OisinTheDeer, commemorating the 2012 London Olympics and Olympic torch procession through the town of Warwick.

2011) and have avoided tweeting items with any political slant or content, or anything that could be construed as 'bad taste'. In recent years, our community-focused agenda has led us to forge stronger links with local businesses and community organisations within the town of Warwick and the county of Warwickshire. Twitter has proved a highly effective medium for this aim, and @OisinTheDeer has contributed significantly to embedding HCW (and specifically the Market Hall Museum) within a thriving and communicative network of local businesses, influential organisations, and individuals. Through informal rapport with local business owners, @OisinTheDeer has afforded the museum an approachable and accessible 'face', promoting trust, integration, and dialogue concerning local commerce, events, and other issues.

The future

Since its inception, @OisinTheDeer has afforded the Warwickshire Museum a continuous public profile, broadcasting/dialogic medium and identity, through a period of profound change in terms of organisation and mission. We aim to continue tweeting for as long as the account remains effective, with reference to followers, tangible impact, and positive feedback from users.

HCW received financial backing from the Heritage Lottery Fund in 2015 to re-develop the Market Hall Museum, Warwick, and further develop the community website 'Our Warwickshire'. Currently (January 2017), the Market Hall Museum is closed to the public, whilst the building is refurbished and new displays planned, designed and installed. Once again, @OisinTheDeer is providing vital continuity during this process, tweeting from his protective crate with progress updates and other news. Additionally, we are planning to move his skeleton to a new position close to the Market Hall Museum's public entrance, affording more opportunities to capitalise upon the popularity of our Twitter account.

Social media are increasingly playing a powerful role in global communication, augmenting traditional broadcasting and dialogic methodologies, and available through a range of widely available mobile technologies. Museums, with their educational agendas, budgetary pressures, and digitised collections are ideally placed to use platforms such as Twitter to communicate and interact beyond what is possible through physical displays, outreach, and conventional websites. @OisinTheDeer is now embedded within HCW's organisation as a vital tool in all areas of public-facing provision.

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Glasgow Museums and Glasgow's natural history societies

Richard Sutcliffe

Glasgow Museums Resource Centre, 200 Woodhead Road, Nitshill, Glasgow G53 7NN, UK

email: richard.sutcliffe@glasgowlife.org.uk

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Abstract

This article looks at the relationship between Glasgow Museums – those museums owned by Glasgow City Council (formerly Glasgow Corporation) and now run on their behalf by Glasgow Life – and the various natural history societies that have existed within Glasgow over the last 165 years, and their many important contributions to the collections and staff of Glasgow Museums. This article demonstrates the enormous benefits to museums of working in collaboration with natural history societies and amateur naturalists.

It does not look at other relationships between the natural history societies and the Hunterian or other museums in Glasgow. Nor does it include the Geological Society of Glasgow (founded in 1858) or the (Royal) Philosophical Society of Glasgow (founded in 1802).

Keywords: Glasgow, museum, natural history society, Andersonian

Glasgow's natural history societies

There have been a number of natural history societies in Glasgow. Information about these was published in the Glasgow Naturalist (Sutcliffe, 2001), but the following provides an outline of them.

The pre-eminent society was also the first: in 1851, nine "gentlemen interested in the pursuit of natural science" agreed to form a society under the name of the Natural History Society of Glasgow (NHSG) (Anon., 1852). These first members were the eminent local naturalists of their day. The Society grew quickly, holding regular meetings and undertaking excursions within the local area (Figure 1).

Other natural history societies also sprang up, some of them ultimately merging with the NHSG:

- The Glasgow Naturalists Society was formed in 1858, and amalgamated with the NHSG in 1866.
- The Glasgow Society of Field Naturalists was established in 1871. They produced a list of the fauna and flora of Clydeside and the West of Scotland for the 1876 meeting of the British Association for the Advancement of Science (BAAS), which was held in Glasgow (British Association for the Advancement of Science, 1876). By doing so, they produced the first broad baseline for biological recording in the area. They amalgamated with the NHSG in 1879.
- The Glasgow Eastern Botanical Society was started in 1876, by members of a botany class at the Bridgeton Mechanics' Institution, and merged with the NHSG in 1898.
- The Glasgow Practical Naturalists was formed in Kelvingrove Museum in 1883, principally for the practical study of entomology. The society

changed its name to the Clydesdale Naturalists in 1886 (this had previously existed under the aegis of the Glasgow Philosophical Society from 1850 – 1865), and merged with the NHSG in about 1890.

Two other important societies then entered the scene: In August 1885, 16 gentlemen who had attended botany evening classes run by Rev. Alexander Stoddart Wilson at Anderson's College (later the Royal College of Science and Technology, and then the University of Strathclyde) decided to form their own society. They took the name the Andersonian Naturalists Society (ANS), considering themselves amateurs in comparison with the more academic NHSG, being "a society intended chiefly to foster the love of science amongst young men, those who are only learning the natural sciences, so to speak, and in no way does it pretend to be a rival to the ... Natural History Society of Glasgow" (Andersonian Naturalists Society, 1885). The following year, the Microscopical Society of Glasgow (MSG) was formed by enthusiasts at a geology class, also at Anderson's College.

By the late 1920s, the three remaining societies (NHSG, ANS and MSG) were all pursuing similar aims, and several members belonged to more than one of them. In 1931, the three societies agreed to merge to form the Glasgow and Andersonian Natural History and Microscopical Society (GANHMS). This name was shortened to the Andersonian Naturalists of Glasgow (ANG) in the 1950s, and the Society was then generally referred to as the 'Andersonian Naturalists'. In 1979, the name changed again to the Glasgow Natural History Society (GNHS), as some members of the public were misinterpreting the name Andersonian Naturalists of Glasgow as Andersonian Naturists of Glasgow – with associated connotations.

Figure 1. Members of the Natural History Society of Glasgow on an excursion in the 1890s. © Glasgow Natural History Society.

The Societies and Glasgow Museums: A Mutual Relationship

Glasgow's first city museum (not including the McLellan Art Galleries, which opened in 1856) was the City Industrial Museum, opened in March 1870. It was housed in Kelvingrove House, a former mansion house owned by the Town Council, in what was then called the West End Park (Figure 2).

Figure 2. Kelvingrove House. The original City Industrial Museum © CSG CIC Glasgow Museums Collection.

The first curator was James Thomson, who was appointed just prior to the museum opening in February 1870. Thomson was a natural historian, which makes his appointment surprising, given it was originally called the City Industrial Museum. He probably had no experience as a curator, and had previously been a gamekeeper at Dunmore Park, near Falkirk (famous for the Pineapple, now a National Trust for Scotland property), and latterly at Blairquhan Castle, Maybole, in Ayrshire. His appointment may possibly have been influenced by references from individuals such as John A. Harvie-Brown, an eminent Scottish ornithologist and member of the NHSG, who had known Thomson since at least the early 1860s. There are several letters from Thomson to Harvie-Brown in the latter's correspondence, now in the collections of National Museums Scotland.

Thomson was already acquainted with the NHSG, and had submitted a "very interesting series of British birds' nests and eggs, which had been sent for exhibition…" in April of 1869 (Anon., 1869). He lost no time in becoming directly involved with the Society, and was appointed a corresponding member in April 1870.

According to the NHSG Constitution, "Persons from whom information upon natural history subjects may be expected shall be eligible as Corresponding Members. ...Corresponding Members shall be entitled to attend all Meetings and Excursions of the Society. They shall not be entitled to vote at any meetings, nor to use

the Library, nor to receive the printed Proceedings. They shall not be liable for Entry-money nor Annual Subscriptions. The Council, however, shall have power to grant all the privileges of Ordinary Members to Corresponding Members, in such cases as it may think fit." (Anon., 1873b)

Thomson was soon showing specimens from the museum's collection at meetings, an early example of outreach. In February 1872, he exhibited some Moa bones and flint scrapers (GLAMG-1870.44). Glasgow Museums' natural history register gives very little information about these specimens:

> Description: Moa bones, New Zealand
> From whom received: Mr Arthur
> Address: Helensburgh

However, the Proceedings of the Society were published regularly, and thus often provide additional information about specimens that was never written down in Glasgow Museums' registers. In the case of the Moa bones, the following is recorded in the Proceedings:

"Mr James Thomson exhibited a valuable series of bones of the Moa from New Zealand, and several flint knives and scrapers which had been discovered in the mound from which the bones had been taken. These excited considerable interest, and the Chairman remarked that the series formed a valuable addition to the Kelvingrove Museum." (Anon., 1872)

Likewise, two "bernicle [sic] geese" were exhibited in 1873 (Anon., 1873a). Again, the accession register entry says very little, but the Society's Proceedings tell us that one of them had face and chin markings with a strong rufous tint. This information might have allowed staff to recognise un-numbered specimens as being one of these birds, but unfortunately these specimens no longer exist.

Sadly, Thomson died on 2 December 1875, aged only 54. Clearly, he was well respected, as the Museum's annual report in 1876 states: "...During the few years he held office, Mr Thomson devoted himself with the greatest enthusiasm to the interests of the museum, and the condition in which he left the collections bear ample testimony to his care and diligence.' (Anon., 1876a). The Society remembered him '...By his urbanity and obliging disposition, he gained the esteem of all with whom he came in contact, and in the occasional meetings of the society held in the rooms of Kelvingrove Museum, he always endeavoured, even at much trouble to himself, to promote the comfort and convenience of the members." (Anon., 1876b)

Robert Gray (a founder member of the NHSG, and author of the Birds of the West of Scotland (Gray, 1871)), wrote to James Lumsden after Thomson's death:

"I am sorry indeed for poor Thomson's family. As you remark the museum authorities will not easily fill up the vacancy. I suspect Thomson hurt himself through hard work in the building. He was often at work at four in the morning and I fear that many a Sabbath was devoted to the collection. I hope his successor may just have the half of his taste, knowledge and energy." (Gray, 1875)

The curator and his family at that time 'lived over the shop' in the museum. With the death of Thomson, his wife, Mary, son, and three daughters became homeless. Subsequently, several members of the Society issued an appeal on her behalf:

"A number of friends of the late James Thomson, Curator of the Kelvingrove Museum, Glasgow (formerly of Dunmore), learning that his Widow and Family are left totally unprovided for, are desirous, out of respect for his talents and moral worth, as a suitable tribute to his memory, to raise a sum of money to assist the Widow in maintaining herself and her Family. Mr Thomas Chapman has kindly consented to act as Treasurer; and friends sympathizing with this object are requested to forward their subscriptions to him…" (Chapman et al., 1876).

Unfortunately, there is no record of how successful the appeal was.

Figure 3. John MacNaught Campbell F.Z.S. (right) with Wm Young R.S.W., in Kelvingrove Museum. © CSG CIC Glasgow Museums and Libraries Collection: The Mitchell Library, Special Collections.

After Thomson's death, James Paton, from Edinburgh, was appointed Curator. John MacNaught Campbell

(Figure 3) was appointed as an Assistant Curator, and he succeeded Thomson in curating the natural history collections. Campbell, who was also responsible for the archaeology collections, was to remain in the post for 49 years, until 1925.

Like Thomson, he and subsequent natural history curators all supported the various natural history societies in Glasgow, and continued to exhibit specimens and provide a venue for meetings.

Figure 4. Collared Peccary (GLAMG-1880.24). © CSG CIC Glasgow Museums Collection.

On 27 April 1880, Campbell exhibited a specimen of a Collared Peccary (*Dicotyles tajuca*) (now [*Pecari tajacu*] (Linnaeus, 1758)). Glasgow Museums' register is short on details: it states only that the specimen came from Dutch Guiana (Suriname), and was a female. However, after some general remarks on peccaries, Campbell told the Society a great deal more:

"The individual now exhibited – a female – was brought alive to this country, and after its death was presented to the Kelvingrove Museum. In a letter, which I received a few days ago, [which unfortunately no longer exists] its former owner says, "When it left Surinam it had its mate shipped with it, but, unfortunately, the male died on the voyage. When it came here in the month of May last it was rather low in condition, but soon picked up. It was very tame, and fond of being caressed or scratched, followed those that looked after it; but it was not often allowed to walk about in the yard, as it sometimes attacked the fowls, and sometimes succeeded, which made the dairy-woman declare 'it had a blood-thirsty nature.' After it had been a month with me, I had a Berkshire young boar placed beside it, but it never got in season, although in general they seemed very friendly. At first it ate the food before allowing the Berkshire to taste, but as the latter got stronger than it, this was reversed, and it had to be fed separately. It knew strangers readily, and did not care for them being near it, and, if they offered to touch it, raised its bristles and snorted, and, if they persisted, it ejected a most offensive matter. After the severe frost it began to fall off in condition, though it took its food, and never seemed to be ill till a few hours before it died." (Anon., 1880)

The Societies' Contributions to Glasgow Museums

The Constitution of the NHSG (Anon., 1873b) includes a clause relating to donations to the Society. Any donations "...may be presented to one of the local museums." The Society also made a point of making specific collections for Glasgow Museums. A formal written agreement for the NHSG to hand over specimens of plants and invertebrates to the Town Council was signed and approved by both parties on 6 October 1881 (Anon., 1881). In the 1880s, the NHSG donated several collections to Glasgow Museums. These included botanical and entomological specimens. The museum's annual report for 1883 reported "The Natural History Society of Glasgow continues to make steady progress in the formation of the British type collections of invertebrate animals and plants for the museum, towards the preparation of which the special committee of the society has already devoted a large amount of time." (Anon., 1883). The Society of Field Naturalists had previously also donated material to the collection in 1873. An entry in the Museum's register for that year states: "Specimens of Botany, being the third lot from the Society of Field Naturalists."

A strong link between the NHSG and Glasgow Museums was formed through Charles Kirk, probably Glasgow's best taxidermist, from 1896 until his death in 1922. He was a member of the Society and exhibited many specimens at meetings. He also produced some wonderful taxidermy for Glasgow Museums, and wrote a paper for the Scottish Naturalist relating to fish in the museums' collections (Kirk,1913).

Another long-standing contribution to Glasgow Museums was from ANG member Dick Prasher (1899 – 1980). From 1964 to 1980, every week during the summer months, Dick would get the train from Dalry, in Ayrshire, to Glasgow, where he would be collected from the station, along with his filled vasculum containing fresh examples of local plants. These would be put into jars and formed a highly informative display of wild flowers on the plant table in the Natural History Gallery. He also passed on valuable identification skills to museum staff. On arrival, Dick would change into his 'museum slippers', officially provided for when he worked in the museum. In 1979, he received an MBE for services to the environment in the west of Scotland (Stirling, 1981).

In 1951 ANG celebrated the centenary of NHSG with an exhibition entitled 100 Years of Natural History in the Centre Hall of Kelvingrove Art Gallery and Museum (Anon., 1952). In 1985, another exhibition – this time celebrating the centenary of the Andersonian Naturalists Society – was also held there, and GNHS organised an associated excursion, and a centenary dinner (Figure 5). This exhibition was opened by Professor Blodwyn Lloyd Binns, then the longest serving member, who had joined the Society in 1934. When she died, in 1991, she left her entire estate (then worth £200,000) to the GNHS. The Blodwyn Lloyd Binns Bequest now uses interest from the capital to pay for a wide variety of projects and research, and to give grants (Downie, 1998). Glasgow Museums has benefitted from some of these grants, for a variety of projects: biological recording projects for Glasgow Museums Biological Records Centre; cataloguing of botanical collections, including the former Strathclyde University herbarium (which Blodwyn Lloyd Binns had herself worked on), and contributions towards some of Glasgow Museums' natural history publications.

Figure 5. Dressed in period costume, members of Glasgow Natural History Society celebrate the centenary of the Andersonian Naturalists Society in 1985. © Glasgow Natural History Society.

The most recent GNHS publication paid for by the bequest was about John Scouler (1804 – 1871), first President of the NHSG and a special research interest of Blodwyn Lloyd Binns (Nelson, 2014). On the cover is Glasgow Museum's specimen (G.1955.76) of 'Scouler's auld heid', Hibbertopterus scouleri (Hibbert, 1836) – an extinct Carboniferous Eurypterid (giant sea scorpion) from Bathgate. An appendix lists specimens relating to Scouler in both Glasgow and Hunterian Museums.

GNHS's regular publication, The Glasgow Naturalist, is a quality peer-reviewed journal dating back to 1909. It is a very appropriate journal in which to publish items relating to Glasgow's collections, and the majority of Glasgow Museums' natural history staff have submitted papers over the years.

A number of individual members of GNHS and its predecessors (or their families) have made notable personal donations to Glasgow Museums over the years. These collections include:

David Robertson Collection (1902.168 and 1914.52)

Robertson (1806 – 1896) was known as the 'Cumbrae Naturalist', and set up the 'The Ark', the fore-runner of the University Marine Biological Station (UMBS) at Millport on the Isle of Cumbrae. Several thousand marine invertebrates, including material from HMS Challenger, were donated to Glasgow Museums by Robertson's widow in 1902. Further material, and her own algae collection, were donated by their granddaughter in 1914. The remainder of Robertson's collection from the UMBS was transferred to Glasgow Museums (NH.2014.1) and the Hunterian Museum in late 2013.

Thomas Gray Collection (1910.7)

Thomas Gray (1820 – 1910) was one of the original founder members of the NHSG. His mollusc collection, which he bequeathed to Glasgow Museums, was, he believed, "the finest and most complete of either public or private to be found in North Britain [Scotland], and contains nearly seven thousand species from all parts of the globe, several of which are unique, many of considerable rarity..." (Sommerville, 1910).

Stirton Collection (1927.8)

James Stirton (c.1833 – 1917) was President of the Glasgow Society of Field Naturalists, and described many new species of both mosses and lichens. His daughters split the collection between Glasgow Museums and the British Museum (Natural History) (now the Natural History Museum) after he died.

Lumsden Collection (Z.1940.38)

James Lumsden (1851 – 1911) was a knowledgeable ornithologist, a close friend of John A Harvie-Brown, and author of the Birds of Loch Lomond. His collection of bird skins was given to Glasgow Museums by his son in 1940.

MacKechnie Collection (B.1981.72)

Robert Mackechnie (1902 – 1978) was a prominent Glasgow botanist. His extensive collection was split between Glasgow Museums and the Royal Botanic Gardens, Edinburgh after he died in 1981.

Clifford Edwards Collection (Z.2010.19)

Clifford Edwards (1913 – 2009) was a professional biologist based near Oban from 1969 until his death. He left his collection of insects, together with his library, to the GNHS in 2010. Like their predecessors, they decided to pass this on to Glasgow Museums.

Peter Macpherson Collection (B.2016.3)

Peter Macpherson (1925 – 2015) was the Botanical Society of Britain and Ireland recorder for VC77 Lanarkshire. His family have recently donated his herbarium to Glasgow Museums, and given a substantial bequest to the GNHS, some of which will be passed onto Glasgow Museums to curate the collection.

Conclusion

This article contains evidence of the mutual benefits to museums, local societies and amateur naturalists of working together. In Glasgow, the city's museums and natural history societies have had a very good relationship for nearly 150 years, and hopefully this will continue for many years to come.

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NatSCA 2016 AGM Minutes

Thursday 21 April 2016, 14:10 - 14:50

The Silk Mill, Derby

Attendees:

Jack Ashby (JA), Paul Brown (PB), David Gelsthorpe(DG), Miranda Lowe(ML), Holly Morgenroth (HM), Roberto Portela Miguez (RPM), Vicky Purewal (VP), Maggie Reilly (MR), Paolo Viscardi (PV), and Donna Young(DY).

1. Apologies for absence

Jan Freedman (JF), Clare Brown (CB), Emma Bernard (EB), Isla Gladstone (IG).

2. Minutes of AGM Thursday 21st May, 2015

Held at the M Shed, Princess Wharf, Bristol Museums, Galleries & Archives as published in Journal of Natural Science Collections 3: 68-77.

There were no issues raised by members at the meeting. These were signed as a correct record of that meeting by the chair.

Proposed: Anthony Roach Seconded: Hannah Allum

3. Chair's Report: Paolo Viscardi

This has been an exciting year for NatSCA, with a very successful conference in Bristol where we explored ideas about how to unleash the potential of museums using social and more traditional media. At the conference our hashtag #NatSCA2015 was trending in the UK – beaten only by Eurovision. This helps to illustrate how effectively NatSCA's members are engaging with social media to share their passion for natural science collections and raise the profile of our sector. This is a heartening prospect, since social media offers a remarkably powerful medium for advocating collections; an increasingly important activity as local authority museums in particular face deeper and deeper cuts.

The funding situation for museums continues to be an issue of concern for NatSCA and we have been working more closely with other Subject Specialist Networks (SSNs) to explore ways of building resilience in the sector. As part of this we have been involved in planning and delivering training to help support museum professionals whose role has broadened to encompass collections outside their areas of expertise, such as the Curating Human Remains workshop organised in collaboration with the Museum Ethnographers Group (MEG), the Society for Museum Archaeology and the Human Remains SSN. We have also delivered training for other SSNs, such as the Identifying Natural Materials course held in Exeter by MEG. Of course, we have also been delivering training more specifically for natural sciences collections professionals, such as the NatSCA Bone Day held in Cambridge. Skills and knowledge transfer is something that we see as being key to building resilience in the sector, so at the moment we are working on a joint funding application to Arts Council England (ACE) in partnership with the Geological Curators Group, to develop further training resources for professionals responsible for natural science collections. If all goes to plan we will be rolling out these resources over the next 18 months – so fingers crossed!

4. Secretary's Report: Roberto Portela Miguez

Trustees' Annual Report for the period

From	Period start date			To	Period end date		
	31	01	2015		31	01	2016

Section A: Reference and administration details

Charity name Natural Sciences Collections Association

Other names charity is known by

Registered charity number (if any) 1098156

Charity's principal address
Natural History Museum
Cromwell Road
London
Postcode **SW7 5BD**

Names of the charity trustees who manage the charity

	Trustee name	Office (if any)	Dates acted	Committee Meetings Attended
1	Jack Ashby	Communications & Marketing	2015-2017	**3 / 4**
2	Clare Brown	Training Co-ordinator	2014-2016	**2 / 4**
3	Paul Brown	Archivist	2014-2016	**4 / 4**
4	Jan Freedman	Journal Editor	2014-2016	**2 / 4**
5	David Gelsthorpe	Bursary Co-ordinator	2015-2017	**4 / 4**
6	Miranda Lowe	Collections at Risk	2015-2017	**2 / 4**
7	Holly Morgenroth	Treasurer	2013-2016	**3 / 4**
8	Roberto Portela Miguez	Secretary	2014-2015	**4 / 4**
9	Vicky Purewal	Conservation	2015-2017	**4 / 4**
10	Maggie Reilly	Membership	2014-2016	**2 / 4**
11	Emma Bernard	Social Media & GCG Rep.	2015-2017	**2 / 4**
12	Paolo Viscardi	Chair	2014-2017	**4 / 4**
13	Donna Young	Training and Conference Co-ordinator	2014-2016	**4 / 4**
14	Isla Gladstone	Ordinary Member	2015-2017	**0 / 4**

Name of chief executive or names of senior staff members (Optional information):

Paolo Viscardi, Holly Morgenroth, Roberto Portela Miguez, Maggie Reilly, and David Gelsthorpe

Section B: Structure, governance and management

Description of the charity's trusts

Type of governing document (eg. trust deed, constitution)	The Constitution was adopted on 7th April 2003
How the charity is constituted (eg. trust, association, company)	Association
Trustee selection methods (eg. appointed by, elected by)	Trustees are selected from membership

Additional governance issues (Optional information)

You **may choose** to include additional information, where relevant, about: • relationship with any related parties	A Memorandum of Understanding was signed between the Natural Sciences Collection Association, the Geological Curators Group and the Society for the Preservation of Natural History Collections on the 26th of June 2014.

Section C: Objectives and activities

Summary of the objects of the charity set out in its governing document	Our mission is to promote and support natural science collections, the institutions that house them and the people that work with them, in order to improve collections care, understanding, accessibility and enjoyment for all.
Summary of the main activities undertaken for the public benefit in relation to these objects (include within this section the statutory declaration that trustees have had regard to the guidance issued by the Charity Commission on public benefit)	Objectives: (1) to advance the education of the public in the care and use of natural sciences collections and specimens (2) to promote for the benefit of the public the highest standards in the preparation, care, conservation, management, interpretation and research of natural sciences collections and specimens (3) for the benefit of the public to promote the science of natural sciences collections conservation and curation Our Focus: ● Community - developing an open, friendly and accessible network for sharing information, experience and skills. ● Support – facilitating the professional development of stakeholders in natural science collections. ● Standards – identifying and promoting good quality practice in the care and use of natural science collections. ● Promoting collections - increasing awareness of the scientific and cultural value of natural science collections. ● Advocacy – challenging neglect of collections and lobbying for the appropriate resourcing of collections for their care and sustainable use.

Section D: Achievements and performance

Summary of the main achievements of the charity during the year

Special mention to the fact that we have amended the constitution to limit the maximum number of committee members from 20 to 15. An email was sent to members informing of this decision and offering the opportunity to express concerns or report objections to this change. The period for objections expired on the 31st of January, so the amendment to the constitution has been passed and made. Thank you members for your support in this particular action.

With regards to this year's performance summary, the funding situation for museums continues to be an issue of concern for NatSCA and we have been working more closely with other Subject Specialist Networks (SSNs) to explore ways of building resilience in the sector. As part of this we have been involved in planning and delivering training to help support museum professionals whose role has broadened to encompass collections outside their areas of expertise, such as the Curating Human Remains workshop organised in collaboration with the Museum Ethnographers Group (MEG), the Society for Museum Archaeology and the Human Remains SSN. We have also delivered training for other SSNs, such as the Identifying Natural Materials course held in Exeter by MEG. Of course, we have also been delivering training more specifically for natural sciences collections professionals, such as the NatSCA Bone Day held in Cambridge. Skills and knowledge transfer is something that we see as being key to building resilience in the sector, so at the moment we are working on a joint funding application to Arts Council England (ACE) in partnership with the Geological Curators Group, to develop further training resources for professionals responsible for natural science collections. If all goes to plan we will be rolling out these resources over the next 18 months.

Our current chair, Paolo Viscardi wants to offer a vote of sincere thanks to the volunteers that keep NatSCA running and to offer congratulations to two members of the NatSCA committee, Clare Brown and Isla Gladstone, on the new additions to their families. Our elected committee spend a huge amount of time and effort on making things happen, in particular our Treasurer Holly Morgenroth, who ends up being at the core of everything that we do. Of course, we also rely hugely on less visible, but no less important volunteers from the general membership. In particular I want to thank Justine Aw who has been both working for NatSCA in a paid capacity with funding from ACE and supporting us extensively in her own time, lending a hand with pretty much everything we do; Glenn Roadley, who has been supporting the committee by updating the jobs page on the NatCSA website (natsca.org/jobs) and helping with electronic bookings; Rachel Jennings who has been editing the NatSCA blog and Facebook page, with Emma-Louise Nicholls and Sam Barnett who have also been working hard to keep the blog regular and active; as well as David Notton, who works hard to support our Editor Jan Freedman in producing the Journal of Natural Science Collections.

Finally on a personal level but I also hope membership will join me in thanking our chair Paolo Viscardi for the sterling work he does steering the society, motivating the fantastic committee we have and for his unquestionable commitment to promote at every opportunity the natural sciences and collections management.

Proposed: Donna Young Seconded: Kate Andrews

5. Election of Ordinary Members of NatSCA committee: Paolo Viscardi

Below are the nominees for NatSCA committee posts to serve from 2016 to 2018 and 2019 in the case of the Treasurer which have reached the secretary.

The membership secretary has checked to see that those proposed, those proposing and those seconding are all present members of NatSCA.

OM 2016-2018	**Paul Brown (NHM, London)**
Proposed: Erica McAlister	Seconded: Clare Valentine
Membership Secretary 2016-2018	**Maggie Reilly (Hunterian Museum, Glasgow)**
Proposed: Geoff Hancock	Seconded: Richard Sutcliffe
Treasurer 2016-2019	**Holly Morgenroth (Royal Albert Memorial Museum, Exeter)**
Proposed: Roberto Portela	Seconded: Justine Aw
OM 2016-2018	**Clare Brown (Leeds Museum)**
Proposed: Rebecca Machin	Seconded: Roberto Portela Miguez
OM 2016-2018	**Donna Young (World Museum, Liverpool)**
Proposed: Wendy Atkison	Seconded: Annette Townsend
OM/Editor 2016-2018	**Jan Freedman (Plymouth Museum)**
Proposed: Darren Mann	Seconded: Mark Carnall
OM/Editor 2016-2018	**Rachel Jennings (Horniman Museum and Gardens, London)**
Proposed: Justine Aw	Seconded: Laura Cronin

Two nominees had requested to be considered for the post of Editor. A ballot among the attending members decided in favour of Rachel Jennings as nominee for the post of Editor. The Society's former Editor Jan Freedman (JF) was nominated for Ordinary Member.

Proposed: Anthony Roach Seconded: Julian Carter

Already in post:

1.	Chair 2014-2017	Paolo Viscardi (Grant Museum, London)
2.	Secretary 2014-2017	Roberto Portela Miguez (NHM, London)
3.	OM 2015-2017	Jack Ashby (Grant Museum, London)
4.	OM 2015-2017	David Gelsthorpe (Manchester Museum)
5.	OM 2015-2017	Miranda Lowe (NHM, London)
6.	OM 2015-2017	Emma Bernard (NHM, London)
7.	OM 2015-2017	Isla Gladstone (Bristol City Museum)
8.	OM 2015-201	Vicky Purewal (Bristol City Museum)

6. Treasurer's Report: Holly Morgenroth

2016-2017 Annual Accounts Summary with 2015-2016 Comparison

Accounts summary 01.02.2016 - 06.07.2016

Income		2016-17	2015-16
Institutional Subscriptions			
Previous Years	160		
Current Year (bank)	1,793		
Current Year (PP)			
Future Years			
		1,953	1,721
Personal Subscriptions			
Previous Years	105		
Current Year	2,746		
Current Year (PP)			
Future Years			
		2,851	3,822
Workshop Income			
Human remains	130		
Law	407		
		537	5,430
Conference Income			
2016	8,511		
		8,511	7,114
Grant Income			
NIP			
			1,400
Other			
Bank interest			
			7
TOTAL INCOME		13,852	19,494

Expenditure		2016-17	2015-16
Running costs			
Committee Expenses	180		
Insurance			
Postage	9		
Bank Charges			
Data Protection			
		189	1,772
Workshops			
Human remains	693		
Law	59		
		752	1,880
Conference			
2016	5,729		
		5,729	5,453
Publications & Information Provision			
Journal print & postage	1,896		
Hair publication			
		1,896	2,017
Projects			
NIP	149		
Bill Pettit Fund			
		149	3,299
Other			
Bursaries	173		
Banner			
Stationery			
			258
TOTAL EXPENDITURE		8,888	14,679

Excess Income over Expenditure	4,964	4,815

Cash Flow Statement					
31.01.2016	Current a/c	£	11,954		
	Deposit a/c	£	12,391		
	Paypal a/c	£	-		
				£	24,344
NB Adjusted balance				£	21,120
06.07.2016	Current a/c	£	16,919		
	Deposit a/c	£	12,391		
	Paypal a/c	£	-		
				£	29,310
NB Adjusted balance				£	24,908

OUTSTANDING EXPENDITURE				
Human remains				
Catering human remains	£	187		
Conference				
Bursaries	£	100		
Speakers expenses confirmed	£	1,097		
Speakers expenses unconfirmed	£	300		
Committee Expenses				
pending	£	128		
expected	£	1,500		
Bursary	£	100		
Bill Pettit	£	1,500		
Data Protection	£	35		
Journal	£	1,900		
			£	6,847
EXPECTED INCOME				
Conference				
Delegates + sponsors	£	2,126		
Law	£	319		
Membership				
2016 payments		unknown		
			£	2,445
Adjusted balance 06.07.2016			£	24,908

NB law expenses still unknown

Proposed: Jack Ashby Seconded: Mark Carnall

7. Membership Secretary's Report: Maggie Reilly

Year: 1 February 2015 – 31 January 2016

There are 265 paid up memberships for year 2015. These break down as 54 institutional subs (4 of these are late subs currently in process) and 211 personal subs.

50 personal subs did not renew and 6 institutional, although two of these are formal resignations, leaving four drop-offs.

There were 56 new members, mostly personal, who joined in the course of the year.

These figures provide an almost identical picture to last year which means that despite non renewals, resignations and so on, I am happy to say we have sustained the 20% in membership reported for 2014.

Membership renewals are sent out every year and are followed throughout the year with assorted reminders. Your society needs your cash to help do all the good and useful things we do so we are grateful to all who pay promptly and the right amount! The latter may be construed as a request to those who pay by standing order to check they have increased the amount from £15 to £20 (and please send us the missing £5!).

The membership database has been cleaned up and members who are two years behind with subs will be removed from it and the mailing list.

Free of charge mailings

We have revised these and now we send the following complementary mailings:
PDF copies to 3 patrons, GCG, SPNHC
We fulfil a legal obligation to send hard copies to seven copyright libraries, and we also send same to the Smithsonian Library. We are revising our contact list for the MA, ICON, ACE, and CEH.

Downloads of past publications are freely available at http://www.natsca.org/publications. Electronic access to the most recently published journal is normally embargoed for a year after publication but in a new service to paid up members we have now enabled password protected download of the Journal immediately.

Proposed: Nigel Monaghan Seconded: Kate Andrews

8. Archivist Report: Paul Brown

PB reported on the successful consolidation of the Society's archival records. RPM and PB collected the records that been deposited in Lapworth Museum. All archival material is now at the Natural History Museum, London, and is currently being sorted before depositing in the archives of this institution.

9. Editorial Report: Jan Freedman – Jack Ashby

Volume 3 was published in late January, and included some very interesting articles on different conservation methods, social media and model making. There was a very interesting study on whether or not museum studies courses are useful for jobs. The Journal also included an up to date article on safely managing asbestiform minerals which is of great use to most curators.

With the old NatSCA News no longer in print, the committee are aware that there was place needed for more informal articles, such as collections moves or book reviews. We have an online Notes and Comments section for these and will continually email round the membership as new articles are uploaded.

After one year of publication, the Journal will be made freely available online. All articles of Volume 1 and 2 are online, so please do share with colleagues. The articles from Volume 3 are online, and available for NatSCA members using the password send out earlier this year. If anyone needs the password, please ask the membership secretary or myself.

The Journal is for you, so please do get in touch if you would like to contribute or if you would like to see a topic covered.

As always, a special thank you to David Notton at the Natural History Museum for his continual hard work and support as a volunteer to the Editor.

Proposed: Paolo Viscardi Seconded: Maggie Reilly

10. Any Other Business

Mark Carnall asked about the links to the Human Remains SSN and PV stated that it hadn't been functioning, but that discussions will continue about a possible merge with NatSCA.

DY confirmed that next year's conference will be hosted by Cambridge.

11. Vote of Thanks

PV offered a vote of sincere thanks to the volunteers that keep NatSCA running and to offer congratulations to two members of the NatSCA committee, Clare Brown and Isla Gladstone, on the new additions to their families. Our elected committee spend a huge amount of time and effort on making things happen, in particular our Treasurer Holly Morgenroth, who ends up being at the core of everything that we do. Of course, we also rely hugely on less visible, but no less important volunteers from the general membership. In particular I want to thank Justine Aw who has been both working for NatSCA in a paid capacity with funding from ACE and supporting us extensively in her own time, lending a hand with pretty much everything we do; Glenn Roadley, who has been supporting the committee by updating the jobs page on the NatCSA website (natsca.org/jobs) and helping with electronic bookings; Rachel Jennings who has been editing the NatSCA blog and Facebook page, with Emma-Louise Nicholls and Sam Barnett who have also been working hard to keep the blog regular and active; as well as David Notton, who works hard to support our Editor Jan Freedman in producing the Journal.

12. Next Committee Meeting

Natural History Museum 8th of July 2015 (11:00 – 15:30)

Close at 14:50, 21 April 2016.

NatSCA Committee

Chair

Paolo Viscardi
Zoology Curator
National Museum of Ireland - Natural History Museum,
Merrion St. Upper,
Dublin 2,
Ireland
T: +353 (0)85 211 6512
E: pviscardi@museum.ie

Treasurer

Holly Morgenroth
Collections Officer
RAMM, Bradninch Offices,
Bradnich Place,
Gandy Street,
Exeter,
EX4 3LS
T: 01392 265 358
E: holly.morgenroth@exeter.gov.uk

Secretary

Roberto Portela Miguez
Curator Of Mammals
Natural History Museum,
Cromwell Road,
London,
SW7 5BD
T: 0207 942 5963
E: r.portella-miguez@nhm.ac.uk

Membership Secretary

Maggie Reilly
Curator of Zoology
Hunterian Museum,
Glasgow University,
Glasgow,
G12 8QQ
T: 0141 330 4772
E: Maggie.Reilly@glasgow.ac.uk

Editor

Rachel Jennings
Documentation Assistant
Horniman Museum and Gardens,
100 London Road,
London,
SE23 3PQ
T: 020 8858 8232
E: rjennings@horniman.ac.uk

Archivist

Paul Brown
Senior Curator,
Department of Entomology
Natural History Museum,
Cromwell Road,
London,
SW7 5BD
T: 020 7942 5196
E: P.Brown@nhm.ac.uk

GCG Representative

Isla Gladstone
Senior Curator Natural Sciences
Bristol Museum and Art Gallery,
Queens Road, Clifton,
Bristol,
BS8 1RL
T: 01179223592
E: isla.gladstone@bristol.gov.uk

Conservation Representative

Vicky Purewal
Pure Conservation
18 Merthyr Road,
Tongwynlais,
Cardiff,
CF15 7LH
T: 07917533411
E: info@pureconservation.co.uk

Ordinary Members

Jack Ashby
Manager
Grant Museum of Zoology,
Rockefeller Building, 21 University St,
University College London, Gower Street,
London,
WC1E 6DE
T: 0203 1082052
E: j.ashby@ucl.ac.uk

Clare Brown
Curator of Natural Sciences,
Leeds Museum Discovery Centre,
Carlisle Road,
Leeds,
LS10 1LB
T: 0113 3782 109
E: clare.brown@leeds.gov.uk

Jan Freedman
Curator of Natural History
Plymouth City Museum and Art Gallery,
Drake Circus,
Plymouth,
PL4 8AJ
T: 01752 30 4765
E: jan.freedman@plymouth.gov.uk

David Gelsthorpe
Curator of Earth Sciences,
The Manchester Museum,
The University of Manchester,
Oxford Road,
Manchester,
M13 9PL
T: 0161 3061601
E: david.gelsthorpe@mancester.ac.uk

Miranda Lowe
Principal Curator
Department of Zoology,
Natural History Museum,
Cromwell Road,
London, SW7 5BD
T: 0207 942 5668
E: m.lowe@nhm.ac.uk

Donna Young
Curator of Herbarium,
World Museum, National Museums Liverpool, William Brown Street, Liverpool,
L3 8EN
T: 0151 478 4269
E:Donna.Young@liverpoolmuseums.org.uk

More information about the committee and their roles is on the NatSCA website.
If you have any concerns about natural science collections, or need some advice on working with specific collections, please do get in touch.

www.natsca.org

NatSCA
Natural Sciences Collections Association

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