

# Broadening the user base of natural history collections

A SYNTHESYS-EDIT workshop

At the Royal Belgian Institute of Natural Sciences

November 4-5, 2008

DAY 1	No.	Tuesday 4th November	
Time		Item	Speaker
9.00		Arrival - Tea & coffee available	
10.00	1	<b>Welcome to RBINS</b>	P.Grootaert
10.10	2	<b>Introduction to meeting content and structure</b> , Expected outcomes	S.Owens
10.25	3	Introduction to European Collections	S.Owens and L. Kriegsman
		<b>Session 1: COLLECTIONS – MANAGEMENT</b>	
10.50	4	Users of new natural history collections: Tissues and DNA collections of MNCN	I. Rey
11.05	5	Zoology Collections at MNCN	J.Barreiro
11.20		<i>TEA AND COFFEE BREAK</i>	
11.40	6	Collections management at RMCA	P.Mergen & G.Cael
		<b>Session 2: COLLECTIONS – USERS AND USAGE</b>	
11.55	7	Demands of African Users of collections	P.Mergen & G.Cael
12.10	8	Uses of preserved botanical collections	P.Stoffelen & A.Bogaerts
12.25	9	Specimen occurrence data for conservation	N.Brummitt
12.40		Group photo	All
12.50		<i>LUNCH</i>	
14.00	10	Collections, Bias & Species Distribution Models	N.Raes
14.15	11	The Swedish Environmental Specimen Bank and the use of collections as an archive of anthropogenic impact on nature.	Y. Lind
14.30	12	Collections for agriculture	YV. Rasplus
15.00	13	Mapping the distribution of vectors: the need for accurate records of disease transmitting arthropods.	A. Estrada-Pena
15.15		<i>TEA AND COFFEE BREAK</i>	
15.35	14	<b>Breakout Groups - Discussions on barriers of use</b>	
17.00	15	Group feedback	All
17.30		<b>DAY ENDS</b>	
19.00		<b>DINNER FOR PARTICIPANTS - LOCATION</b> In 't Spinnepopke, 1 Place Jardin Aux Fleurs	

DAY 2		Wednesday 5th November	
Time	Item		Speaker
9.00	Arrival - Tea & coffee available		
9.30	17	Outcomes from day 1	R.Huxley
		<b>Session 3: Broadening user base and mechanisms for further improvements to use of collections</b>	
10.00	18	Interesting examples	S.Owens
10.15	19	New Perspectives: exploring the arts and humanities potential of the Natural History Museum collections	J.Harvey
10.30	20	Potential new collaborations with / among EPSO members for future research	K.Metzalff
10.45	21	Digitisation of Natural History Collections...Search for a Strategy	P.Seltmann
11.00	<i>TEA AND COFFEE BREAK</i>		
11.20	22	Prospects and limits of NHC specimens in population genetics	P.Wandeler
11.35	23	Introduction to the "International federation/consortium of scientific collections"	P.Grootaert
11.50	24	Global Biological Resource Centres	D.Smith
12.05	25	<b>Break-out on mechanisms recommendations for EDIT and SYNTHESYS</b>	
13.15	<i>LUNCH</i>		
14.45	27	Group feedback	
15.15	28	Outcomes from day 2 and next steps	S.Owens
16.30	<b>MEETING CLOSES</b>		
	<i>Tea &amp; coffee available</i>		

## Abstracts

### Item 4: Users of new natural history collections: Tissues and DNA collections of MNCN

The tissue and DNA collection of the MNCN began its activity in 2002. Today it includes 26.213 specimens in its catalogue with over 50.000 samples already classified and available to the scientific community. Approximately 250.000 samples more are also deposited and are currently in the process of being classified.

The popularity of this collection is growing and the number of users requiring tissues or extracted DNA is steadily increasing. Until the present 1.180 samples have been sent to 110 different researches, some of them with the required permits as they belong to species included in annex I of CITES.

The catalogue number of the samples in our collection is a voucher number, which appears in Genbank where currently 211 sequences belonging to our frozen samples, can be localized.

### Item 6&7: Collections management at RMCA and collaboration with African Users

*Michel Louette, Hein Vanhee, Garin Cael and Patricia Mergen*

The Royal Museum for Central Africa (RMCA) is a multidisciplinary institution with a special focus on Sub-Saharan Africa. The Museum is a world centre in research and knowledge dissemination on past and present societies and natural environments of Africa, and in particular Central Africa, to foster a better understanding and interest in this area and, through partnerships, to substantially contribute to its sustainable development with target audience being both the public at large and the scientific community.

The three sections 'Vertebrates', 'Entomology' and 'Invertebrates non-insects' in the Department of African Zoology and parts of the Sections 'Agricultural Economy' (for wood biology) manage collections of about 10million specimens of animals and 56,000 wood specimens of 13,600 different botanical species. The researchers carry out studies on animals and woody plants within their natural environment in Africa. Their aim is to gain more insight into biodiversity and to stimulate interest among the general public and the scientific community.

The geology and Mineralogy department hosts more than 350,000 rocks, minerals and fossils, plus an unique collection of 20,000 maps and 300,000 aerial Photographs. Its objectives are to act as an information and research centre for the study of geological processes in Africa and their influence on society, to distribute information about the physical environment and natural resources of Central Africa. They are realised in partnership with African researchers and institutions.

The aim of the Cultural Anthropology Department is to conduct a diachronic and synchronic study of African societies and the inherent meaning of their cultural products. The Department carries out its task through scientific research, including fieldwork, through the study and provision of documentation and by managing and developing its collections. In this way, the Department seeks to promote better understanding of Africa's sociocultural diversity, more specifically that of Central Africa, not only in the scientific community but also among the general public, through ongoing cooperation with African researchers. The department is composed of the following sections: Ethnography, Prehistory and Archaeology, Ethnosociology and Ethnohistory, including the Human Sciences Documentation Centre, Linguistics and Ethnomusicology and Collection Management including for example about 180,000 Ethnographic objects, 410,000 photographic archives, 6,000 hours of traditional music recordings and over 1km of archives including the famous Stanley Archives.

The talk will briefly introduce the museum and the various collaboration programs with African partners focusing on collections and be followed by an overview of the collection management activities at RMCA.

#### **Item 8: Herbarium uses of preserved botanical collections**

*Piet Stoffelen, Elmar Robbrecht and Ann Bogaerts*

Initially preserved botanical collections were mainly intended to be used for the study and illustration of taxonomy, nomenclature, morphology and distribution of plant species.

Throughout the years collections grew steadily and herbaria became vast warehouses of raw data on plant diversity. The recent progress in sciences, analytical techniques and information technology increased the diversity of users and uses significantly. With the growing diversification of uses, exchange of information between users and collection managers, became more and more a problem. Today's practice fails in keeping track off and documenting these uses.

The presentation briefly summarizes the current uses of botanical collections based on experiences of collection managers and literature study. We also question how we can improve the exchange of information of the collections between collection managers and users.

#### **Item 9: Specimen occurrence data for conservation**

*Neil Brummitt*

The talk will focus on species conservation assessments and the application of specimen data to the IUCN Categories and Criteria. This relies on having a database of georeferenced specimens and has associated issues (accuracy, precision, handling error etc.). We have automated GIS algorithms, but these automated preliminary assessments are not sufficient for a full IUCN assessment, so I will also talk about supplementing measures of EOO and AOO to satisfy the IUCN subcriteria, which we also do with GIS. We routinely use ecological niche modelling, including predicted range size under future climate scenarios, in carrying out full assessments; but there is a trade-off here - we want to know most information about species which have small ranges and few specimens, since these are more likely to be threatened, but there is often insufficient data to use some of the more recent techniques reliably. I will present some preliminary results from our project, looking at global patterns of plant diversity and conservation need.

#### **Item 10: Collections, Bias & Species Distribution Models**

*Niels Raes*

Digitized natural history museum- and herbarium collections serve a wide range of applications, often related to geographic distributions of species. In order to use the collections for spatial analyses they need to be georeferenced. Although the coordinates of many collection localities are available in gazetteers, especially many localities from remote (tropical) regions are still not

georeferenced. Fortunately, many institutions also harbour a large collection of maps that were made during the collection expeditions of which they store the specimens. To make the collections from these remote areas available for spatial analyses we introduced a technique known as georegistration, a process that allows the geographic positioning of digitized expedition maps (with their collection localities). This is achieved by matching the maps in a geographic information system (GIS) with SRTM digital elevation data and high-resolution satellite images. Once georegistered, the coordinates of the collection localities can easily be extracted. This process allowed us to reduce geographical collection bias of our study area to a minimum.

Few regions have been uniformly sampled, however, leaving large regions under-sampled or not sampled at all. To be able to predict the potential presence and absence of species even for these areas has resulted in the development of species distribution modelling techniques (i.e. GARP, Maxent, BioClim). I will briefly demonstrate the methodology of species distribution modelling and illustrate some of its applications with our work on the botanical diversity and phytogeography of Borneo.

### **Item 11: The Swedish Environmental Specimen Bank and the use of collections as an archive of anthropogenic impact on nature.**

*Ylva Lind*

The purpose of the Swedish Environmental Specimen Bank (SESB) has been to provide material for monitoring, screening and research. Today, the main use of the collections that is located at the Swedish Museum of Natural History (SMNH) is environmental monitoring of contaminants. An important user is the Environmental Monitoring Programme, initiated in 1980 by the Swedish Environmental Protection Agency (SEPA). This year is also the official start of SESB although a yearly collection of certain species (pike, starling) started already in the 1960s. The Department of Contaminant Research at SMNH is responsible for collecting, keeping and, together with SEPA to administer the SESB. The monitoring and screening studies financed by SEPA are performed by the department of Contaminant Research at SMNH together with different laboratories.

Another important user of SESB are researchers and SESB samples have been used in several retrospective studies both on earlier known chemicals and on chemicals that have been discovered to occur in biota since the start of SESB. Examples are studies on polybrominated flame retardants and fluorinated substances where SESB provided samples that made it possible to study the levels in biota from the late 1960s up until the present time. SESB samples have also been used in studies on effects of contaminants. A delicate issue to consider concerning the use of SESB collections is that the material is mostly destroyed by usage. Some matrices such as guillemot egg that has been collected since the 1960s are very popular in retrospective studies on new substances because they are so well examined and this can be a problem as the material is limited. Other uses of SESB material besides for chemical analyses of contaminants are studies on bone material involving the measurement of bone density as a parameter in studying the effect of environmental contaminants. Material from SESB has also been used in DNA studies. As new methods develop such as analyses of stable isotopes there are new possibilities to use material from SESB and this ought to broaden the user base of the collections.

### **Item 13: Mapping the distribution of vectors: the need for accurate records of disease transmitting arthropods.**

*Agustín Estrada-Peña*

Current concerns about the spread of some prominent arthropod-borne requirements, as to be useful in mapping potential areas of disease. Diseases are supported by the use of distribution models projecting the expected range of the vectors. These models commonly use the known (or realized) distribution of the vector, projecting its range by using climate and/or landscape-derived attributes. Leaving aside other limitations of these models, their robustness lies on a set of accurate and reliable records of the organism to be mapped. However, distributional records of parasites may have strong inaccuracies, like different collection pressures, local interest on a given species, or seasonal dynamics. Lack of adequate georeferencing and reference to large administrative divisions is also a serious limiting factor in the use of these datasets. The presentation provides some examples about the need to have adequate sets of data and their main requirements, as to be useful in mapping potential areas of disease.

### **Item 19: New Perspectives: exploring the arts and humanities potential of the Natural History Museum collections**

*Julie Harvey*

Funded by the Arts and Humanities Research Council, the Natural History Museum has recently completed a project scoping the potential of using the specimen, library and archive collections as a resource for arts and humanities academic research.

The project called *New Perspectives* included input from 70 academics representing 20 UK universities. The presentation reviews the findings of the project and how the Museum intends to build on this initiative.

### **Item 20: Potential new collaborations with / among EPSO members for future research**

*Karin Metzloff*

EPSO aims to advance plant science in Europe. In this context EPSO aims to encourage closer collaboration between the different plant science experts, such as for example ecologists, conservation biologists, cryologists and molecular biologists that are relevant to the discussion at this workshop.

EPSO started a first survey among its members asking which developmental and molecular biologists etc. would be interested in natural history collections such as herbaria

A first summary of the responses will be presented together with an offer to hold a small brainstorm meeting of potential new users and representatives from the EDIT and SYNTHESIS consortia early 2009.

EPSO has a solely academic membership of 185 research institutes, universities and research departments from 27 countries in Europe and beyond, representing over 24 000 plant researchers and staff. In addition, EPSO has 1 200 personal members.

The mission of EPSO is to promote plant science and plant scientists, to represent plant scientists in discussions about future plant science programme priorities across Europe, to provide an authoritative source of independent information on plant science, and to promote training of plant scientists to meet 21st century challenges in breeding, agriculture, horticulture, forestry, plant ecology and sectors related to plant science.

To achieve its mission, EPSO advises policy and decision makers at national and European level on science policy, in the Initiative for Science in Europe and the European Technology Platform 'Plants for the Future'. EPSO supports plant scientists via the EPSO conferences including support grants for junior and eastern scientists, workshops, tutorships and as information broker via EPSO News and its website.

### **Item 21: Digitisation of Natural History Collections...Search for a Strategy**

*Peggy Seltsmann*

Natural history collections worldwide house an estimated 3.0 billion conserved specimens. This represents an immense knowledge base on global biodiversity. Currently, this knowledge base is largely under-utilised. To fully realise their potential, specimen information must be made accessible in an international network.

Currently, less than 60 million specimen-based records are accessible through the Global Biodiversity Information Facility (GBIF), but this is only a tiny fraction of the total wealth of information that could be put to use. Therefore, the goal is to develop a Global Strategy and Action Plan for the Digitisation of Natural History Collections (GSAP-NHC) that helps to prioritise digitization activities, and that helps to raise resources essential for industrializing the process of natural history data digitization and free and open data mobilisation.

### **Item 22: Prospects and limits of NHC specimens in population genetics**

*Peter Wandeler*

Museums and other natural history collections house millions of specimens. With the advent of molecular genetic approaches these collections have become the source of many fascinating studies particularly when historical with present-day genetic diversity has been contrasted. However, because DNA extracted from NHC samples is degraded, analyses of such samples are technically demanding and many potential pitfalls exist. Here, I will present some of the central scientific question that can be addressed by using specimens from NHC in population genetics along a set of guidelines that outline the steps necessary to begin such investigations.

### **Item 23: Introduction to the “International federation/consortium of scientific collections”**

*Patrick Grootaert*

Scientific collections are essential parts of the research infrastructure of all countries with scientific enterprises, and they are critical to many areas of science, from microbiology to space science. The OECD Global Science Forum authorized a workshop on Policy Issues Related to Scientific Research Collections, which was held in Leiden, the Netherlands, in 2007. A second, follow-up workshop was held in Washington, DC, in July 2008. A meeting of the GSF in October 2008 held in Rome endorsed the reports of the both meetings, with the task to produce a detailed implementation plan for a future international coordinating mechanism for research collections.

The Mission of an International Coordinating Mechanism for Scientific Collections would include the following:

- Enable global-scale research activities
- Promote an international culture of collections as large-scale distributed infrastructure
- Improve access to and mobility of collection objects and associated data, and the people associated with them; foster capacity-building
- Identify and integrate existing standards of community practice, and develop additional standards deemed necessary

In order to fulfill this mission, this coordinating mechanism should undertake the following actions:

- Create a research roadmap in coordination with the user community
- Create self-assessment tools for collections
- Set standards of practice
- Promote research on scientific collections and collections management
- Provide opportunities for the global collections workforce
- Provide a clearinghouse mechanism/interface between collection-based science and broader societal concerns/policies

### **Item 24: The Global Biological Resource centre Network and the World Federation for Culture Collections**

*David Smith*

Biologists require high quality living resources preserved well for continuity of processes as in most instances collecting materials as they are needed is generally labour intensive and often it is difficult to re-isolate a strain with identical properties. Culture collections or Biological Resource Collections (BRC) have a role to play using state-of-the-art preservation techniques to maintain such resources. The World Federation for Culture Collections, World Data Centre for Microorganisms lists 536 collections with over 1.8 million strains almost half of which are fungi (<http://www.wfcc.info>). It is essential that research is based on well preserved, representative materials and carried out in compliance with the Convention on Biological Diversity.

The OECD BRC initiative to establish the virtual infrastructure of the Global Biological Resource Centre Network (GBRCN) encourages collections to meet the high quality operational standards required. The Task Force established by the OECD member countries which included 10 observer countries reported in 2000 (<http://oecdpublications.gfi-nb.com/cgi-bin/oecdbookshop.storefront>). The report argued the need for biological resource centres, strengthened and modified to meet the requirements of the 21st century, and recommended the creation of the GBRCN. The subsequent years concentrated on developing operational guidance that would deliver high quality materials and associated data in a legal and operational framework that met national rules, regulations, legislation and conventions. In 2007 the results of this seven year activity were published, *OECD Best Practice Guidelines for Biological Resource Centres (Online)*, <http://www.oecd.org/dataoecd/6/27/38778261.pdf>. It is intended that BRCs adopt these practices to ensure that users get legitimate and safe access to high quality biological materials and associated information.

Increasingly molecular techniques are being used to characterise strains to assure organism authenticity. Unfortunately some databases contain erroneous data that can undermine research. A recent study (Bridge *et al.*, 2004) revealed that of 206 named sequences of the ribosomal RNA gene cluster in fungi up to 20% were considered unreliable. PCR fingerprinting techniques have been used to demonstrate that poor freeze-drying and cryopreservation technique can induce polymorphisms in preserved fungi (Ryan *et al.* 2001). Users are faced with the problems of different access controls, uncertainty of product quality and gaps in coverage, where can they get exactly what they need? The German Government sponsored GBRCN demonstration project will show how synergies between

collections will underpin the developing bioeconomy and better meet customer needs. A concerted effort is needed to support the development and long-term sustainability of culture collections so that they may support global research and development.

### **References**

Bridge, P.D., Spooner, B.M & Roberts, P.J. (2004) Reliability and use of published sequence data. *New Phytologist* **161**, 15.

Ryan, .M J.,, Bridge, P.D Jeffries, P. & Smith, D. (2001). Developing cryopreservation protocols to secure fungal gene function. *Cryoletters* **22**, 115-124.