PROGRAM AND ABSTRACTS

For the twenty-sixth annual meeting of the

SOCIETY FOR THE PRESERVATION OF NATURAL HISTORY COLLECTIONS

Meeting jointly with the

Natural Science Collections Alliance

Sustainable Museums – Sustainable Collections

23 – 28 May 2011
San Francisco, California
Hosted by the California Academy of Sciences

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SPNHC
ADVANCING COLLECTIONS CARE

The **Society for the Preservation of Natural History Collections (SPNHC)** is an international organization devoted to the preservation, conservation and management of natural history collections. Its members have strong interest in the value of natural history collections and the role they play in society of understanding the history of life and the factors influencing global environmental change.

NSC
ALLIANCE

The Natural Science Collections Alliance is a Washington, D.C.-based nonprofit association that supports natural science collections, their human resources, the institutions that house them, and their research activities for the benefit of science and society.

Welcome from SPNHC

Dear participants to the 2011 Joint Meeting of the SPNHC & NSCA:

It is with great pleasure that I welcome you to San Francisco. As you may know, ten years ago SPNHC held its 16th Annual Meeting here, at the California Academy of Sciences. We now return for our 26th Annual Meeting to witness the enormous transformation that recently took place in this institution. For many museums, historic buildings are adapted to meet modern standards; but few have actually metamorphosed into a Platinum-Level LEED-certified, architecturally innovative, multifunctional facility.

The Annual Meeting is our opportunity to interact directly with our colleagues; to establish and maintain our professional network; to find out what's new in the field of natural history collection management and conservation, and to celebrate some of our accomplishments. This year, our colleagues from Natural Science Collections Alliance are joining us and will share some of the initiatives they have taken to address the challenging economic and political climate in the United States.

The program organized by the Local Organizing Committee promises to fill our schedule with informative, practical and exciting sessions, great workshops, some fun activities, and certainly the opportunity to explore the CAS's new building. I want to express my sincere appreciation to them, on behalf of all participants, for the enormous amount of work they have invested to make this a memorable event. After organizing the 2010 annual meeting, I hold a lot of respect for those who voluntarily offer to host an annual meeting. I also would like to thank all the individuals that are presenting oral papers and posters and leading workshops; your participation is what makes this meeting such a valuable part of our continuous professional development.

As I hope I expressed amply last year, I want to sincerely thank all our sponsors and vendors for your invaluable support. Notwithstanding the importance of your financial support, your presence at our annual meetings represents a significant added value to our professional networking and development efforts. I encourage all participants to visits the vendors' booths at the tradeshow and find out what they have to offer beyond their much appreciated presence at this meeting.

Finally, if this is your first SPNHC conference, I invite you to participate in the special breakfast for newcomers and to introduce yourself to members of the SPNHC Council; we would like to get to know you better and help you in getting the most out of this your first of what we hope will be many meetings.

Enjoy!

Jean-Marc Gagnon
President, Society for the Preservation of Natural History Collections

Welcome from local committee

We are very happy to welcome you to the beautiful city of San Francisco, and to the heart of one of the city's iconic cultural centers – Japantown. We have a great technical program lined up for you, as well as several social events and workshops that promise to be fun and enlightening. This year we are hosting participants from Australia, Belgium, Canada, Germany, England, Spain, Sweden and Wales.

When we initially chose the theme of this meeting "Sustainable Museums/Sustaining Collections", it was a reference to our new museum building. However, over the past couple of years, this theme has taken on another meaning, as we have all been facing difficult times with the recent worldwide financial downturns. But this week we are all here to share our knowledge, engage with our colleagues, have a good time, and celebrate all that is so great about our organizations and about what we do.

Thank you all for your time and efforts to participate in our meeting and we hope that you have a great time while you are here in San Francisco.

Sincerely,

The SPNHC/NSCA 2011 Local Organizing Committee
California Academy of Sciences

Welcome from NSCA

I am delighted to join Jean-Marc Gagnon, President of the Society for the Preservation of Natural History Collections, in welcoming you to this joint meeting of SPNHC and the Natural Science Collections Alliance at the California Academy of Sciences in San Francisco. I also want to give special thanks to Greg Farrington, CAS Executive Director, and to the host committee of CAS, for giving us such a beautiful home for this rendezvous.

The need for our organizations has never been more compelling. The populations and ecosystems our collections represent suffer unrelenting pressure from direct human settlement, climate change, invasive species, pollution, and direct exploitation. The knowledge gained by specimen-based research is directly relevant to addressing these threats, and the specimens themselves and their genetic codes preserve fundamental information for known and undetermined research and applications in the future.

I salute you all for being part of the enterprise we share though natural history collections, and I hope you all have a great time at this meeting!

Bill Brown
President, Natural Science Collections Alliance

Society for the Preservation of Natural History Collections

SPNHC

ADVANCING COLLECTIONS CARE

June 11-16, 2012 27th Annual Meeting

Yale University New Haven, Connecticut USA

Emerging Technology and Innovation is the theme that has been chosen for the SPNHC 2012 annual meeting to be held at Yale University in scenic New Haven, Connecticut. The Yale Peabody Museum of Natural History will be hosting this meeting that will focus on looking at the tools, innovative methods and collaborations that will bring natural history collections into the future.

Our venue will be the Omni Hotel located in downtown New Haven within steps of the city green and Yale's historic old campus. General sessions will be held at this luxury hotel, while social events will give a glimpse of the Peabody collections as well as other Yale collections and the campus. Field trips will allow you to discover a maritime seaport living history museum, the largest metropolitan zoo in the US, or a 200 million-year old fossil trackway in situ.

The local organizing committee would like to officially invite you to attend the SPNHC 2012 annual meeting. Please visit us on our website www.peabody.yale.edu/SPNHC2012 for updates and join us on our Facebook group, search: SPNHC 2012.

See you next summer!
SPNHC 2012 Local Organizing Committee

Humanity's past survives ... centuries later.

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Even the robots admired the design and storage capacity of these cabinets. May they rust in peace.

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Rebecca Peters
Rebecca Morin
Jean DeMouthe
Moe Flannery
Dave Catania
Charlotte Pfeiffer
Sara Stebick

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Sara Stebick

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Rosalyn Henning
Velma Schnoll

Field Trips
Dave Catania
Debra Trock
Jean DeMouthe
Jon Fong
Sara Stebick
Moe Flannery
Rebecca Wenk
Andrew Doran

General Conference Information

Registration and Information Desk

The registration and information desk is located in the Imperial Foyer. It will be open during the following hours:

Monday, May 23	8:00 a.m. – 5:00 p.m.
Tuesday, May 24	8:00 a.m. – 5:00 p.m.
Wednesday, May 25	8:00 a.m. – 5:00 p.m.
Thursday, May 26	8:00 a.m. – 5:00 p.m.
Friday, May 27	8:00 a.m. – 12:00 p.m.

Please wear your registration badge at all times.

Breaks and Meals

Breakfast – A Continental breakfast will be available in the Imperial Foyer, Monday through Friday from 7:30 – 8:30 a.m. for all registrants.

Morning and Afternoon Breaks – Provided for all conference participants. All breaks will be held in the Imperial Ballroom.

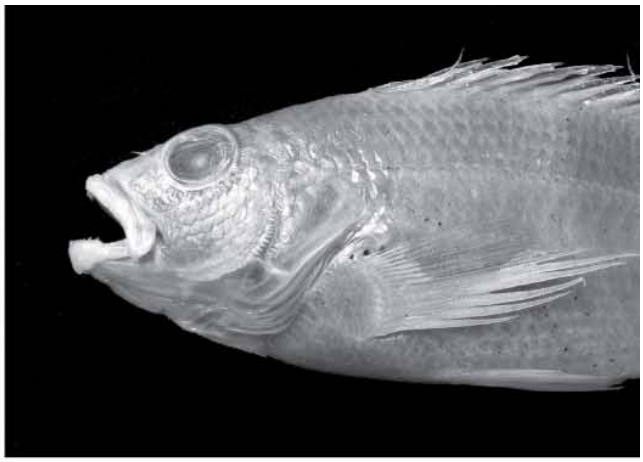
Lunch – Provided on Wednesday at the Vendor Lunch. This will be a boxed lunch and the lunches are reserved for individuals who indicated that they would be attending the Vendor Lunch on their registration forms. No unregistered walk-ins, please.

For all other days/events, lunch will not be provided. There are numerous inexpensive options located in the adjacent Japan Center and across the street in the Buchanan Mall. For field trips and workshops, please refer to the Field Trip/Workshop Information Pages in this program.

Dinner provided as follows:

- Monday and Friday SPNHC council meetings – Sandwich/Salad/Pasta buffet
  (non-council SPNHC members, on your own)
- Tuesday at the Icebreaker Soirée (hors d'oeuvres, not full dinner)
- Wednesday at "Wednesday Wild" (hors d'oeuvres, not full dinner)
- Thursday at the Banquet (tickets required)

For a list of restaurants and businesses near Hotel Kabuki, see the Japantown brochure in your registration bag.

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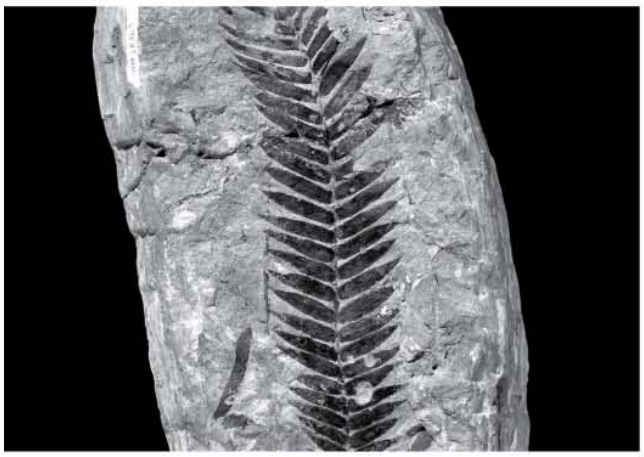
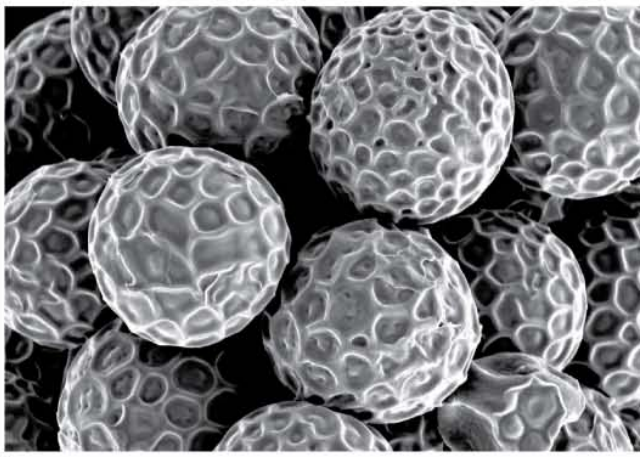
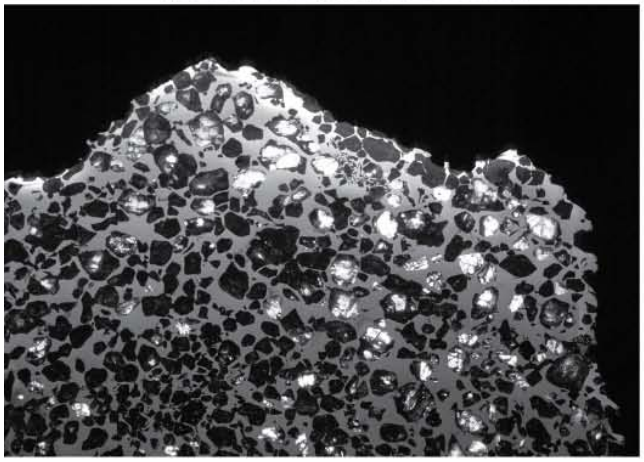
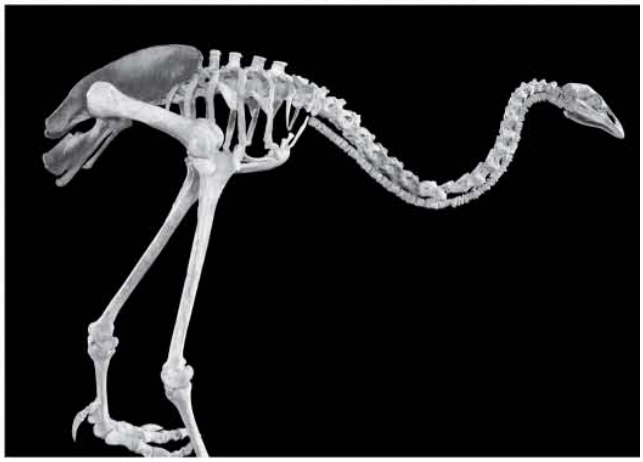

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Social Events

Joint SPNHC/NSCA Icebreaker Soirée

Tuesday, May 24
6:30 – 8:30 p.m. Imperial Foyer, Hotel Kabuki

Wednesday Wild Mixer

Wednesday, May 25
7:00 – 10:00 p.m. African Hall, California Academy of Sciences*
**Transportation to the Academy will be on your own. Directions for taking public transportation are available in the program. A limited number of shuttles will run after the event to bring you back to the Kabuki. For those who have rented a car, we encourage you to arrange to transport some passengers.*

SPNHC Banquet

Thursday, May 26
6:30 p.m. – 12 a.m. Sakura Room, Hotel Kabuki
Cocktails* at 6:30, dinner begins at 7:00.
**A drink ticket will be provided for one free drink during cocktail time, and a glass of wine will be served with dinner. After dinner drinks will be a cash bar. Be sure to bring the ticket that comes with your registration designating your choice for the plated dinner.*

Collection Tours

Enjoy an afternoon touring various collection areas at the newly rebuilt California Academy of Sciences on Friday May 27th beginning at 2pm. Transportation to CAS is NOT provided. Please plan on using public transportation (see detailed instructions at the back of this program). All tour attendees must enter CAS through the Staff entrance on Middle Drive. A sign-up sheet is available at the registration table. Please sign up for only one tour. Two tour choices are:

Tour 1 - Ornithology & Mammalogy, wet collections, Entomology, Library
Tour 2 - Anthropology, Geology, Botany, Invertebrate Zoology

Field Trips

Join us for Tuesday field trips to places near and far. One half-day and two full-day field trips will be leaving from the front of the Hotel Kabuki. Transportation is provided for these three trips.

Birding the Chain of Lakes – Meet Moe Flannery at the Hotel Entrance at 7:45 a.m.
Monterey Bay – Meet Jon Fong in front of the hotel – Bus #1 at 8:15 a.m.
Wine Country – Meet Sara Stebick in front of the hotel – Bus #2 at 8:15 a.m.

For people attending the **San Francisco Arboretum & Conservatory of Flowers**, meet Rebecca Wenk at the Hotel entrance at 9:15. She will help you navigate the public transportation system to Golden Gate Park.

People taking the **Cruise the Bay and Fisherman's Wharf** trip need to meet Jean Demouthe at 9:00 a.m. at Pier 43 ½ near the Red and White Fleet office. There is a map with detailed instructions, including estimated travel times at the back of the program book to help get you there. *Be sure to dress warmly; no matter what the weather seems at your starting point (hotel, home), it is sure to be COLD on the Bay.*

For those of you traveling across the Bay to tour the **Berkeley Natural History Museums**, please meet Andrew Doran outside the Downtown Berkeley BART station (corner of Shattuck & Center) at 12:45 p.m. There is a map with detailed instructions, including estimated travel times at the back of the program book to help get you there.

Saturday Workshops

Workshops will be held from 9am – 5pm at the California Academy of Sciences. Transportation to CAS is NOT provided. Please plan on using public transportation (see detailed instructions at the back of this program). All workshop attendees must enter CAS through the Staff entrance on Middle Drive.
Lunch is on your own at either the CAS café or in the neighborhood.

When you arrive at CAS, the folks at the reception desk will be expecting you. Those of you attending the Poisons workshop will be directed to the correct room by the reception staff. People for the Imaging workshop will be met by a workshop participant, who will escort you to the appropriate room.

Please note, the elevator at the east end of the building, the stairwell doors and many of the rooms in our building require a staff badge to open. If you take restroom breaks during your workshop, please don't wander into a stairwell or elevator without an escort.

Please be sure to wear your meeting badge at all times while you are in the building.

Information for Presenters

Instructions for Oral Presenters

All talks, including DemoCamp presentations, are 20 minutes. Time will be strictly enforced due to the double session schedule. You may use your 20 minutes however you wish, but this time includes set-up for DemoCamp presenters. If more than one author wishes to speak on a single presentation, this is fine, as long as the 20 minute limit is observed.

If you are giving a PowerPoint presentation in a technical session other than DemoCamp, you must use one of the Macintosh (Apple) computers that will be set up for this purpose. You may not use your own laptop. If you have created your presentation on a PC, we advise that you view it ahead of time on a Mac to make sure there are no configuration problems. There will be a computer available at the registration table for this purpose.

To load a PowerPoint presentation, you must provide the file on a thumb drive to the technician in the room designated for your session, during any breaks, but at least one hour (or the day before) your session begins. If a technician is not available to load your presentation, please do so yourself. There will be designated folders on the desktop for each session. Do not wait until just before your session starts to load your presentation. No files will be loaded during a session. Files must be labeled with YOUR LAST NAME. Files that are called something like “spnhc talk” or “bug lecture” will not be accepted.

Posters and Poster Session

Posters will be on display throughout the meeting in the Imperial Ballroom. If you arrive during the day on Tuesday, please hang your poster sometime between the hours of 1 and 5 p.m. If you arrive after 5 p.m. on Tuesday, please hang your poster prior to 10:00 a.m. on Wednesday. Materials to hang your poster will be available at the registration desk.

On Friday morning, poster authors are requested to be present at their posters from 9:30 to 10:30 to talk with people and to answer questions about their presentations. Posters may be removed any time after 10:30 am Friday.

WI-FI

Wi-Fi is available throughout the building; log-in information will be posted as necessary.

Instructions for Oral Presenters

All talks, including DemoCamp presentations, are 20 minutes. Time will be strictly enforced due to the double session schedule. You may use your 20 minutes however you wish, but this time includes set-up for DemoCamp presenters. If more than one author wishes to speak on a single presentation, this is fine, as long as the 20 minute limit is observed.

If you are giving a PowerPoint presentation, you must provide the file on a thumb drive or CD to the technician in the room designated for your session, at least one hour (or the day before) your session begins. Do not wait until just before your session starts, and no files will be loaded during a session. Files must be labeled with YOUR LAST NAME. Files that are called something like “spnhc talk” or “bug lecture” will not be accepted.

Transportation & Museum Visits

Public Transportation

MUNI (bus and trolley) costs $2 per ride. Enter by the front door of the vehicle and pay the driver, who will issue you a paper transfer, which you will need if your journey requires more than one bus. You must also keep the transfer available at all times as proof of payment. Each paper transfer is good for 2 hours.

Cable Cars run on several routes through the east and north parts of the City. One way ride is $5.00. The best places to get on the cable cars are the turn-arounds at Ghirardelli Square (north) and Powell & Market.

BART charges according to how far you go on the system. All stations have machines for ticket purchase. BART runs under Market Street, and does not extend north of there. This is the best way to get to the east bay (Berkeley, Oakland, etc.)

Badge Admission to the Academy

Your SPNHC registration badge will get you into the California Academy of Sciences at any time during the week. Please enter by the staff entrance, on the south side of the building complex. This is the building with the big glass wall. Do not go in the front door.

The exception to this will be on Wednesday night, for *Wednesday Wild,* during which everybody must come in the front door.

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Program at a Glance

Saturday & Sunday, 21 & 22 May

Workshop: GIS
(University of California, Berkeley)

Monday, 23 May

7:30 – 8:30 Continental Breakfast		
8:00-5:00 Registration		
Committee Meetings (Osaka room)	**Committee Meetings (Spring room)**	**(Garden A room)**
8:30 –9:30 Mentorship	8:30 –9:30 Ethics	
9:30 –10:30 Best Practices	9:30 –10:30 Professional Dev.	
10:30-11:00 Break	10:30-11:00 Break	
11:00 –12:00 Long Range Planning	11:00 –12:00 Documentation	
12:00 –1:30 Lunch	12:00 –1:30 Lunch	
1:30 –2:30 Membership	1:30 –2:30 Conservation	1:30 – 2:30 Legs & Regs
2:30 –3:30 Publications		
3:30 –4:00 Break	3:30 –4:00 Break	
4:00 –5:00 Web	4:00 –6:00 Conference	
	6:00 –10:00 First Council	

Tuesday, 24 May

8:00 - 5:00 Registration	
7:30 – 8:30 Continental Breakfast	7:30 SPNHC First-timers Breakfast (Garden A)
1:00-5:00 Vendor & Poster Set Up	
Field trips:	
All day: Monterey Bay (8:15 to 5:00-ish)	
Wine Country (8:15 to 6:00-ish)	
Morning only: Bay cruise (9:00 – 11:00)	
Birding in GG Park (7:45 – 12:00)	
Mid-day: Arboretum & Conservatory (9:30 – 3:00)	
Afternoon only: UCB Museums (1:00 – 5:00)	

Wednesday, 25 May

7:30-10:00 Poster Set Up
7:30-8:30 Continental Breakfast
8:00-5:00 Registration
8:00-5:00 Vendor Trade Show

General session (Sakura room):

8:30-10:00 Introduction, Welcome, Keynote Speaker
10:00-10:30 Break
10:30-12:00 NSCA Panel
12:00-1:30 Vendor Lunch (ticket required)
1:30 – 3:00 Plenary Session on Collection Sustainability
3:00 -3:30 Break
3:30-5:20 Technical Session #1: Sustainability
7:00 – 10:00 Wednesday Wild @ CAS (wear badge, bring ticket)

Thursday, 26 May

7:30-8:30 Continental Breakfast
8:00-5:00 Registration
8:00-5:00 Vendor Trade Show

General Session (Osaka room):

8:30 –10:10 Technical Session #2
10:10-10:30 Break
10:30-12:10 Technical Session #4
12:10-1:30 Lunch
1:30-2:50 Technical Session #6
2:50-3:20 Break
3:20-5:00 Technical Session #8
5:00-5:10 Technical Session Closing remarks
6:30 –12:00 Reception, Dinner, Dancing (Sakura Room)

General Session (Spring Room):

8:30 –10:10 Technical Session #3
10:10-10:30 Break
10:30 -12:10 Technical Session #5
12:10 -1:30 Lunch
1:30-2:50 DemoCamp; Session #7
2:50-3:20 Break
3:20-4:40 DemoCamp: Session #9

Friday, 27 May

8:00-12:00 Vendor Trade Show
8:30-9:30 Special Interest Groups (Spring Room):
botany, wet collns, education & exhibits
9:30-10:30 Poster Session with Authors + coffee break
10:30 –12:00 General Annual Business Meeting (Sakura Room)
12:00 –2:00 Lunch & Travel to CAS
2:00 – 5:00 Collection Tours at CAS
6:00 – 10:00 Second Council Meeting at Hotel (Spring Room)

8:30-9:30 Special Interest Groups (Osaka):
zoology, geology, anthropology
10:30-5:00 Poster Take Down
12:00-5:00 Vendors Take Down

Saturday, 28 May

Workshop: Poisons in Collections
(Boardroom, CAS)

Workshop: Imaging
(Classroom, CAS)

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Detailed technical program

Authors	***Title***	***Session***	***StartTime***
	Wednesday morning 8:30 – 12:00		
SPNHC, NSCA, & Local Committee	**Welcome to SPNHC 2011**		**8:30**
Craig Moritz	**The 21st Century Natural History Museum: Science for understanding and sustaining biodiversity**	**Keynote speaker**	**9:00**
Gropp, Mares, Brown, Guralnick	**Federal Science Policy and Natural Science Collections**	**NSCA panel discussion**	**10:30**
	Wednesday afternoon 1:30 – 3:00		
Huxley	**Natural history collections as large-scale infrastructures: European and International initiatives to improve research access & sustainability**	**Plenary session**	**1:30**
Desmet, Brouillet, Ballargeon, Macklin, Hyde, Bruneau	**Canadensys and colleagues: Mobilizing biodiversity data across Canada**	**Plenary session**	**2:00**
Schindel	**SciColl: Scientific Collections International**	**Plenary session**	**2:30**
	Wednesday afternoon 3:30 – 5:10		
Collins	**Sustaining collections for the future – Can museums develop new techniques to reduce energy requirements for preserving complex natural history collections**	**1**	**3:30**
Hatton	**The Hart collection of British birds: A chequered history – a sustainable future?**	**1**	**3:50**
Huxley & Maldar	**Removing the barriers to molecular access to collections**	**1**	**4:10**
Ariño	**Specimens at large**	**1**	**4:30**
Quaisser & Haeuser	**Integrating taxonomic institutions in Europe: lessons learned from the five year project EDIT**	**1**	**4:50**
White, Jones, & Van Aken	**Managing expectations: Defining collections requirements at a university natural history museum**	**1**	**5:10**

	Thursday am 8:30 – 10:10 (concurrent w/ #3)		
Russell, Van Camp, & Sheffield	**The Field Book Project**	**2**	**8:30**
Starly, Raman, Cifelli, & Davies	**Digitally enabled engineered reconstruction of a baby Apatosaurus**	**2**	**8:50**
Jordan, Jarrell, Ickert-Bond, McDonald, Cicero, & Koo	**The Arctos/TACC collaboration: Shared digital preservation and access**	**2**	**9:10**
Doran, Kasameyer, & Beidleman	**Digitizing the past to interpret the future: The archives of the University & Jepson Herbaria**	**2**	**9:30**
Mudge, Schroer & Lum	**Robust computational photography techniques for collections conservation, research, and public access**	**2**	**9:50**
	Thursday am 8:30 – 10:10 (concurrent w/ #2)		
Beccaloni	**Super-sized spirit sustainability: The complexities of large-scale wet curation**	**3**	**8:30**
Buffington & Gates	**From field to screen and beyond: New methods for the collection, curation & illustration of parasitic Hymenoptera (Insecta)**	**3**	**8:50**
Huntzinger, Droege, & Griswold	**Natural history collections, an essential resource for building interactive bee identification guides**	**3**	**9:10**
McAlister & Broad	**When it all goes wrong – the development of an entomological salvage plan**	**3**	**9:30**
Martin	**Sustainable furniture for sustaining collections**	**3**	**9:50**
	Thursday am 10:30 – 12:10 (concurrent w/ #5)		
Carter	**I think it's Shellac…" Adventures with FTIR spectrometry at the National Museum Wales**	**4**	**10:30**
Chef Holmberg	**Coordinating the conservation of Swedish natural history & cultural history collections**	**4**	**10:50**
Henry	**Dead and dangerous! Managing contaminated taxidermy specimens throughout the exhibition development process**	**4**	**11:10**
Ayres & Eklund	**California Academy of Sciences' pest management program: New building, new worries…**	**4**	**11:30**
Kageyama	**Museum emergency preparedness and response specifically against earthquakes: A literature review**	**4**	**11:50**

	Thursday am 10:30 – 12:10 (concurrent w/ #4)		
Russell & Bryant	**Using herbarium specimens as a means of determining change over time**	**5**	**10:30**
Bryant, Russell	**Sustaining herbarium collections through place-based research and public programs collaborations**	**5**	**10:50**
Harding, D	**Little black seeds and their friends: Identifying plant materials in ethnographic objects from the Amazon Basin**	**5**	**11:10**
Mitrow & Catling	**Collection network – the best source of information on invasive alien plants**	**5**	**11:30**
Snow, Harbottle, James, Ranker, Thomas & Lorence	**The Consortium of Pacific Herbaria: A new research and collections network for Oceania**	**5**	**11:50**
	Thursday pm 1:30–2:50 (concurrent: DemoCamp #7)		
Schuda & Neuhaus	**The zoological wet collections of the Museum of Natural History Berlin: Recent improvements in collection management and storage**	**6**	**1:30**
Crimm & Goulette	**From 49 to 1: Consolidating 49 DMNS collections spaces into 1 new facility**	**6**	**1:50**
Hoffman & Doran	**Deploying CollectionSpace at UC Berkeley – a community source collection management system for the future of museums at Berkeley**	**6**	**2:10**
Maldar & Huxley	**Assessing your collections management**	**6**	**2:30**
	Thursday pm 1:30 – 2:50 (concurrent w/ #6)		
Barber, Lafferty, & Landrum	**Recent advances in SALIX, a semiautomatic label information extraction system using OCR**	**7 DemoCamp**	**1:30**
Bentley, Granzow-de la Cerda, & Specify Software Project staff	**Specify 6 SGR – Scatter, Gather, Reconcile**	**7 DemoCamp**	**1:50**
Best, Neill, & Moen	**The Apiary project – a framework and workflow for extraction & parsing of herbarium specimen data**	**7 DemoCamp**	**2:10**
Dou, Hanken, Ludaescher, Macklin, McPhillips, Morris.P, Morris.R, & Wang	**Building specimen-date curation pipelines using Kepler workflow technology in a filtered push network**	**7 DemoCamp**	**2:30**

	Thursday pm 3:20–5:00 (concurrent: DemoCamp #9)		
Freeman & Harris	**Collaborate, collect, classify, catalogue, curate: A novel approach to building collections**	**8**	**3:20**
Mayer	**The history of the Field Museum's geology department – Fossil Invertebrates Division: How annual reports & museum bulletins can enhance knowledge of collections**	**8**	**3:40**
Malloy, Hattori, & Barker	**The Nevada State Museum, Carson City - A case study on the curation of federal collections.**	**8**	**4:00**
Bardolph	**Preserving a woven legacy: Collections management of Native American baskets**	**8**	**4:20**
Huxley, Maldar, & Bisang	**Daubenton-Leonardo: Alternative funding for collections management training**	**8**	**4:40**
	Thursday pm 3:20 – 5:00 (concurrent w/ #8)		
Koo, Spencer, Cicero, & McDonald	**Arctos: A collaborative collection management information system**	**9 DemoCamp**	**3:20**
Morris, Eastwood, Haley, & Ford	**The MCZ's ImageCapture application for supporting an efficient data capture workflow in entomological collections**	**9 DemoCamp**	**3:40**
Mudge, Schroer, & Lum	**Reflectance transformation imaging (RTI) for empirical documentation of natural history collections**	**9 DemoCamp**	**4:00**
Rios & Bart	**Overview of the GEOLocate web application**	**9 DemoCamp**	**4:20**
	Friday am 8:30 –12:00		
	Special Interest Groups: Botany, Wet Collections, Education, Exhibits	**Spring Rm**	**8:30**
	Special Interest Groups: Zoology, Geology, Anthropology	**Osaka Rm**	**8:30**
	Poster Session with Authors	**Imperial Ballroom**	**9:30**
	General Annual Business Meeting	**Sakura Rm**	**10:30**

Abstracts for Plenary Session

Canadensys and colleagues: Mobilizing biodiversity data across Canada

Desmet, P.[1], Brouillet, L.[1], Baillargeon, G.[2], Macklin, J.[2], Hyde, D.[3], Bruneau, A.[1]

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[2]Agriculture and Agri-Food Canada, [3]NatureServe Canada.

As noted in the recent report by the Canadian Council of Academies, Canadian biological collections hold more than 50 million specimens, containing a wealth of information that could potentially inform biodiversity-related decisions. Estimates indicate a similar number of observational data. This Canadian biodiversity information is highly fragmentary however, with substantial gaps in the digitization of the collections and with only a fraction of the data available online (NatureServe Canada 2010). In response to this, Canadensys (www.canadensys.net) was established through a grant from the Canada Foundation for Innovation (CFI) to coordinate efforts to publish biodiversity data from university collections and botanical gardens. Headquartered at the Université de Montréal Biodiversity Centre, this consortium comprises 11 universities and five botanical gardens, and unites 35 Canadian researchers. Canadensys collectively holds over 13 million specimens, of which approximately 20% are now databased and will be published through its own web portal and that of the Global Biodiversity Information Facility (GBIF). Over the past two years Canadensys, the Canadian Biodiversity Information Facility (CBIF, www.cbif.gc.ca) and NatureServe Canada (www.natureserve.ca) have begun collaborating to ensure compatibility of data and to represent Canada at international biodiversity informatics conferences. The next logical step in this process of coordinating efforts is to involve other data-holding networks as well as a broad cross-section of Canadian data users in academia, government and industry. Advances in informatics tools, standards and expertise make this a perfect time to tackle the need to increase access to and use of biodiversity information by orders of magnitude via a Canada-wide effort.

Natural History Collections as large-scale infrastructures: European initiatives to improve research access and sustainability

Huxley, R.

Science Directorate, Natural History Museum, Cromwell Road, London SW7 5BD

The large museums and botanic gardens of Europe are the biological and geological diversity equivalent to the large telescope arrays available to the astronomy community or the large accelerators used by the physicists. This vast collections infrastructure is distributed through institutions of varying age, size and management methods. A number of projects have been initiated to improve access to these infrastructures and also integrate and standardize these collections and their management.

The SYNTHESYS consortium provides funding to facilitate access to European collections but also addresses the underpinning challenges of collections and data management and the need for common standards and shared best practice to ensure access for the future. It has delivered a number of products to date from training courses, collections management benchmarking systems and mechanisms to facilitate data sharing. It is also addressing barriers to the specific needs for extraction of DNA from museum collections through a series of research activities.

The Collections Policy Board (CPB) is a sustainable and continuing work package of the now finished European Distributed Institute of Taxonomy (EDIT). The CPB is a group of senior management staff from the major European collections dedicated to delivering a number of cross-European policy level products such as common loan policies and orphan collections strategies.

SCICOLL: Scientific Collections International

Schindel, D.
Museum of Natural History, Smithsonian Institution, P.O. Box 37012, MRC-105, Washington, DC 20013-7012

Scientific collections have become much more visible recently for two very different reasons. Collections have been central to some breakthrough discoveries stemming from the use of new analytical technologies applied to old specimens, while ironically, many collections are under-resourced and some are being 'orphaned' by their host institutions. 'Scientific Collections International' (SciColl; see www.scicoll.org<http://www.scicoll.org>) is emerging as an international coordinating mechanism to improve and promote collections across the spectrum of scientific disciplines: anthropology, archaeology, biology, biomedicine, earth and planetary sciences, environmental science, technology, and other fields that rely on object-based collections. SciColl will operate as a convener and coordinator of Working Groups and Symposia devoted to:

- Developing and promoting interdisciplinary research programs and projects that rely on the integration of information from collections in different disciplines, thereby increasing the scope, quantity, and impact of research generated by collections;
- Improving the electronic documentation of collections in online databases and the interoperability of these databases across disciplines, thereby increasing accessibility of collections; and
- Creating an international, interdisciplinary network of collection professionals for the purpose of identifying, sharing, and disseminating standards and effective practices in collection management and use.
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SciColl began in 2006 as an initiative of the OECD Global Science Forum (GSF) and it has developed under the guidance of an international Steering Committee. A call for letters of intent to join SciColl<http://www.scicoll.org/sites/default/files/SciColl%20Call%20for%20Interest%20-%2016%20Nov.pdf> has been sent to the GSF delegates and to government agencies and research institutions involved in collections. SciColl will operate as a member organization served by a small Secretariat Office that is supported by member contributions. SciColl's Terms of Reference and the calls for letters of intent and applications to host the Secretariat Office are available at www.scicoll.org<http://www.scicoll.org>.

The Second International SciColl Conference will be held at the Melbourne Museum in Australia on 2-4 February 2011. The conference will include a scientific symposium that explores how collections can be brought to bear on three global interdisciplinary research topics (climate change, food security, and human migration). The Melbourne Conference will also include the final business meeting before the formal signing of Memoranda of Understanding by members of SciColl's Executive Board which consists of representatives of contributing members.

Abstracts for Oral Presentations

Specimens at large

Ariño, A.H.
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The role of Natural History Collections (NHCs) as repositories of key information for understanding change in ecosystems can hardly be understated. Yet for this stupendous information to be put to use, it must first be known, and then become accessible. Digitizing this vault of information can be material for, i.e., ecological predictions tied to climate change. Biodiversity information initiatives such as the Global Biodiversity Information Facility (GBIF) are here to facilitate making openly available all this information.

But we do not know much information is, or can be made, available from NHCs. A common repository with metadata from all existing collections does not exist yet. Despite large efforts, there remains a hidden section of the vault that has not been exposed and, perhaps, may never be.
This contribution explores the problem of assessing the universe of specimen-level data existing in NHCs in absence of a complete, worldwide census. Three general approaches are presented, and preliminary results of a pilot study based on digitally-available data are given. Probabilistic models involve crossing data from a set of biodiversity datasets and estimating the likelihood of totally obscure data from the fraction of known missing data. Distribution models aim to find the underlying mathematical distribution of collections' compositions, estimating their hidden sectors. Finally, case studies generalize from the comparison of known digitized and undigitized data from sample collections.

These three independent models converge towards a bracket slightly below 2 billion records, somewhat lower than older estimates. Even though this may seem hopeful, the fact remains that the vast majority of information is still lying in unreachable databases, or has not been digitized at all. Efforts to try to make these NHCs emerge in the digital universe seem more justified than ever.

California Academy of Sciences' pest management program: new building, new worries…

Ayres, R., Eklund, L.
California Academy of Sciences, 55 Music Concourse Drive, San Francisco, CA 94118

The California Academy of Sciences recently moved back to Golden Gate Park into a brand new Platinum LEED facility. The facility's design integrates the Academy more sensitively into the park, making nature part of the building's structure. Additionally, the design interweaves departments, hiding collection spaces behind administrative office and meeting areas. This new approach resulted in a challenging environment for pest management. In the past, pest management relied on isolation of collections and regular or as-needed treatments of specimens, including applications of toxic chemicals. Health and safety concerns, have led our institution to move away from this approach. Guidelines for LEED certification added an additional layer, with light and air requirements included among the criteria. With all of these considerations, the Academy has created a new pest control strategy involving numerous measures used in combination with a strong educational component for both staff and visitors. An institutional policy, zoning, signage, and quarterly inspections are just some of the ways the Academy has protected the integrity of the collections and the health of staff and visitors.

Preserving a woven legacy: Collections management of Native American baskets

Bardolph, P.
San Francisco State University, 1600 Holloway Avenue, San Francisco, CA 94132

By combining practical and cultural care of basket collections museums can not only preserve these objects for the future but also better connect to the communities they serve. The purpose of this study was to determine the best practices for the care of basket collections, acknowledging both practical concerns and Native requests. Research methods included a review of literature and case studies of three museums with substantial Native basket collections, all of which demonstrate exemplary collection management practices.

Through these methods, a resource of ideal collection management standards for practical and cultural care of baskets has been created. This includes storing, handling, exhibiting, packing, and cleaning baskets, as well as information on the history of pesticide use, integrated pest management methods, and documentation and record keeping. Cultural requests are addressed, in addition to practical concerns, including loans to Native communities, repatriation, and indigenous curation methods. This research was conducted for the completion of a Masters thesis in the Department of Museum Studies at San Francisco State University.

Super-sized spirit sustainability: The complexities of large-scale wet curation

Beccaloni, J.
Department of Entomology, Natural History Museum (NHM), Cromwell Road, London SW7 5BD, UK.

Museum collections stored in alcohol have specific requirements for long-term storage and usage, but these complexities are compounded when a collection is very large. How are these sustainability issues addressed and overcome, and how are large collections developed? The Arachnida and Myriapoda collection at the NHM is presented as a case study. The collection dates back to the 1840s, has world-wide coverage, and is scientifically very important. The collection consists of more than 21,300 jars (containing in excess of 12,780L of alcohol).

The housing issue is addressed first, by following the journey of the collection from its former archaic 1920's home, to state-of-the art facilities in the world-famous Darwin Centre. Discover how the collection was prepared and transported for this large move, and how it is curated in its new environmentally-controlled environment. The problematic question of prioritising curation within large scale-collections was solved by undertaking a conditions survey and this is briefly discussed.

The collection is developed through donations and exchanges with other institutions around the world, and current world taxonomic catalogues are used for its arrangement. There is a large amount of material that has not yet been identified, and development through scientific visitor and amateur group access, plus loans is discussed. Low staffing levels are always problematic, especially with large collections, so the subject of volunteer assistance will be briefly explored. Additionally, the importance of databasing large collections will be highlighted. Work on the collection is by no means nearing its end – indeed, further developments planned include: obtaining funding for short-term curation staff; completion of a database of unidentified material and the possibilities of more fieldwork to 'fill in the gaps', and these will be evaluated.

Sustaining herbarium collections through place-based research and public programs collaborations

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[2] US National Herbarium, Smithsonian Institution, Washington, DC 20560

Collections research and field work by the US National Herbarium has already improved awareness and appreciation of more than a century of plant collecting in the San Jacinto and Santa Rosa Mountains of California. Sustaining a locally-based version of this effort into the future will require support from inside and outside: from the institutions, science and natural resource management fields that are obvious clients for such data, and also from the public at large. This presentation will report on activities developed by the Smithsonian in collaboration with the Riverside museum - and with other agencies, around the nation and in Riverside County - to bring the project's results into the domain of formal and informal learning activities. Programs have been designed for families as well as workshops for educators and professional scientists from a variety of disciplines, all with the goal of broadening participation in monitoring the region's natural resources, and assisting the progress of scientific analysis. These activities have also served to increase the visibility of several of the region's museums and herbaria, research programs at area universities, management and interpretive services at federal, state and local units of natural resource agencies, and the environmental services of several non-governmental organizations. As a foundation for steadily increasing involvement, and with planning assistance from the National Park Service, the Riverside museum and its collaborators are developing a strategic plan for ongoing educational programs of this type, under the banner "Riverside-Smithsonian Citizen Science".

From field to screen and beyond: new methods for the collection, curation, and illustration of parasitic Hymenoptera (Insecta)

Buffington, M., Gates, M.
Systematic Entomology Laboratory, USDA/ARS, c/o National Museum of Natural History, Smithsonian Institution, Washington, DC 20013

A significant portion of the 'taxonomic impediment' for parasitic Hymenoptera (Insecta) surrounds the collection of fresh material from various biogeographic regions, as well as illustrating the myriad of new species through taxonomic publications. The collection and processing of large bulk samples of arthropods is a time intensive endeavor. If the target taxa are small (1.0–5.0 mm), such as parasitic Hymenoptera, the challenge is even greater. First, we present on some techniques that we have formulated or modified that are designed to enhance the speed and efficiency by which bulk field samples can be processed. Techniques include a modified deployment system for Malaise traps, a fractionater for separating large arthropods from the small ones, and a rotating intern pool for sorting, mounting and labeling. Second, we present on some micro-photographic techniques for illustrating the species we have collected. We have developed mounting techniques that minimize the 'observer effect' while photographing small wasps, and allow us to work seamlessly between light microscopy and scanning electron microscopy. Additionally, we have some specialized LED illumination domes adapted for use with a compound microscope that help resolve very small specimens. Together, these techniques help us shorten the time lag between specimen acquisition and species description.

'I think it's Shellac….' Adventures with FTIR spectrometry at the National Museum Wales

Carter, J.
Amgueddfa Cymru – National Museum Wales, Cathays Park, Cardiff, UK. CF10 3NP

Over the past 10 years the National Museum Wales (NMW) has been attempting to improve and develop the analytical equipment base available within the museum. A key area that lacked any analytical resource was for the analysis of organic materials. As a result, in 2003, the museum purchased an FTIR (Fourier transformed infra red) spectrometer to start to address this analytical gap. FTIR spectrometry potentially offers a practical and robust technology for analysing the chemistry of materials and specimens within the natural history collections, but how well does it perform in this museum world? This presentation will explore the experiences of using the technology within the NMW, from routine materials identification to applying the acquired data within more complex studies requiring the use of multivariate statistics. The aim is to give a practical insight into how a medium sized museum such as NMW has been able to utilise the technology in both research and for improving collection care and conservation. Overall the equipment has proved robust and has provided a useful organics analysis base to the facilities available within the museum.

Coordinating the Conservation of Swedish Natural History and Cultural History Collections

Chef Holmberg, I.
Swedish National Heritage Board, Department of Conservation, Box 1114, SE62122 Visby, Sweden

The Swedish National Heritage Board is tasked by the government to play an active, unifying role in cultural heritage work and to ensure that cultural heritage is preserved and utilized in the best possible way. We also have a responsibility to further the discussion surrounding the concept of cultural heritage and how it relates to issues regarding democracy and power, affiliation and isolation, and how it can provide perspectives on the present and the future.

Since January 2010 we also have a national role in coordinating conservation of our cultural heritage. This includes objects, buildings and ancient remains. The task is about building and supporting networks, documenting, sharing experiences and knowledge, but also to work for the needs in developing methods in conservation and in competence.

This means that we will work strategically and with long-term perspective with the purpose of keeping the objects in our museums, churches and historic buildings in good shape so they can be kept for the future.

Sweden has a strong tradition in working with the preservation of our cultural heritage both regarding Cultural History collections and to Natural History collections. This new assignment gives us the opportunity to work with those collections from a common point of view.

Our task in coordinating conservation is new, but regarding experiences from other nations, both close to us and some further away as here in the USA and Canada, we can see that coordination of museums and conservation have existed for a long time. I will in my talk present how we have chosen to work with these questions but I also look forward to listening to your ideas and experiences.

Sustaining collections for the future – Can museums develop new techniques to reduce energy requirements for preserving complex natural history collections

Collins, C.
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Led by discussions at BIZOT Group meetings, there is a recognition that museums need to approach long-term collections care in a way that does not require excessive use of energy, whilst recognizing their duty of care to collections. National Museums Directors Conference (NMDC) in the UK stated a general agreement that it is time to shift museums' policies from the prescription of close control of ambient conditions to conditions that reflect a more mutual understanding of the real conservation needs of different categories of object.

To improve the preservation of the collections, Staff at the Natural History Museum has developed the CSIP (Collections Standards Infrastructure Project) environmental standards that benchmark environmental parameters for the generic storage and display of museum collections. These standards (based on published research) have established the baseline for storage of collections in new collection spaces and for retrofitted collection spaces.

Combined with the development of a cross-museum environmental monitoring system, improved storage standards and improved exchange of data with the building management staff these standards are now being used to ensure that the museum's collections will be held economically and at a carbon saving that meets the museums goals to be the most sustainable museum in the UK and a reduction in its carbon emissions by at least 7%.

Will the drive to reduce energy costs reduce our ability to maintain collections that increasingly require sensitive non-ambient environmental conditions or will it push us to develop increasingly sustainable techniques to preserve the complex biological and geological data sets preserved in natural history collections?

From 49 to 1 – Consolidating 49 DMNS Collections Spaces into 1 New Facility

Crimm, W. [1], Goulette, K.[2]
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[2] Denver Museum of Nature & Science, 2001 Colorado Boulevard, Denver, CO 80205

The evolutionary process of designing a state of the art collection facility is complex and it often presents unique challenges and unintended outcomes. More than a year ago the Denver Museum of Nature & Science began working with Walt Crimm, then with EwingCole, to design the Rocky Mountain Science Collections Center (RMSCC) with the goal of consolidating collections that are currently in 49 substandard locations in the existing building. The RMSCC is designed to achieve the highest standards for collection preservation while maximizing staff efficiencies and addressing human health and safety. Data gathering and associated planning exercises take a great deal of time and should be completed in advance of the fast-paced design process. Collection planning, collection space requirement development, and collection risk assessment prepared staff to make credible resource requests and prioritize design requirements. Key consultants augmented staff skill sets to accomplish these exercises. Cross-disciplinary teams of staff working with the architect resulted in a design that benefited from diverse opinions and expertise. Establishing fundamental goals, such as developing approaches to maximize the flexibility of space utilization over time, the incorporation of passive risk management, and standardization of storage and other equipment, can help ensure alignment across all project budgets. Consistent and ongoing staff participation in the design process is required for a successful design outcome.

Digitizing the past to interpret the future: The archives of the University & Jepson Herbaria

Doran, A. S., Kasameyer, A. F., Beidleman, R. G.
University & Jepson Herbaria, University of California, Berkeley, California 94720

The University and Jepson Herbaria Archives are one of a number of ongoing, on-line digitization projects (the Jepson Flora Project and the Consortium of California Herbaria being two other examples) and we continue to receive large collections of mostly uncurated material. There is a need to establish more user traffic, more on-line content and permanent, sustainable curation for the collections.

Increasingly, the relationship between the archives, literature, and specimens is being realized and our current catalog of the archives highlights the need for increased documentation and relational links between our collections.

This talk will demonstrate our new archives database (Archon) and include highlights from the archives including John Muir's correspondence with California's first 'state forestry botanist' and civil war veteran John Gill Lemmon, field books of multiple botanists including Willis Linn Jepson, Ynes Mexia and Joseph Rock and photos from many early Sierra Club trips, guest books, portraits and paintings. Recent botanical research supported by our archives includes work on the history of the Botany Department of the California Academy of Sciences, the historical ecology of the San Francisco Bay Area, and the role of women in botany. Moreover, the research value of our archival collections transcends botany as reflected by the diverse interests of our visitors ranging from the Civil War to the history of the tanning industry in California.

Combined with specimens and literature the extensive correspondence, field books, and even poetry found within our archives gives users unique insights into the scientific and cultural development of this state and beyond. Establishing a long term, relational database that reflects these multi layered and rich resources are now a high priority for the University and Jepson Herbaria.

Collaborate, Collect, Classify, Catalogue, Curate: A novel approach to building collections

Freeman, E.[1], Harris, L.[2]
[1]Marine Biodiversity Center, [2]Polychaete Section, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, CA 90007

Specimen acquisition is vital for museum growth and research but frequently funds are not available for field work. Large, government-funded surveys produce thousands of samples that can be utilized by researchers, but these often languish on shelves for years before being disposed of by administrators unaware of their value. The deposition of survey materials in museums provides an ideal solution to both situations. Unfortunately, these collections often come with their own set of problems. Data may be lacking or incorrect. Huge numbers of specimen lots arrive housed in inadequate containers with cryptic or minimal labels. Months or even years of staff effort may be required to database, process and shelve the material. Even then, the identifications may be poor, done by inexperienced taxonomists and ultimately not worth the time and effort involved. How to solve this dilemma?

The Division of Invertebrate Studies at the Natural History Museum of Los Angeles County has initiated a proactive approach with stringent guidelines. Rather than rely on potential donors to contact us after their surveys are over, we seek out upcoming projects which will generate well-preserved specimens identified by taxonomic specialists. From the project's beginning we work with the parties involved to budget for curation supplies, establish standardized databases that can be easily imported into our format, and train their personnel in museum-quality curation techniques. This innovative collaboration has resulted in a highly efficient and rapid system beneficial to all partners.

Little black seeds and their friends: Identifying plant materials in ethnographic objects from the Amazon Basin

Harding, D.G.
Carnegie Museum of Natural History, 5800 Baum Blvd, Pittsburgh, PA 15206

The Section of Anthropology of the Carnegie Museum of Natural History has a large ethnographic collection from the Amazon Basin, with a considerable number of items of personal adornment. The materials used are all organic, and much of it from the animal kingdom has been identified. The plant materials are much more difficult, especially the ubiquitous little black seeds, whose genus and species vary widely by tribal group and geography. Direct examination of herbarium

specimens, book research, and ultimately, DNA analysis have been used to identify seeds and other botanical materials. Molecular research has not been used in this way before, and opens up a whole

The Hart Collection of British birds: A chequered history - a sustainable future?

Hatton, J.
Horniman Museum & Gardens, 100 London Road, Forest Hill, London, UK, SE23 3PQ

The Horniman Museum's Edward Hart Collection of cased British birds is one of the three very best collections of this type to have survived more or less in tact from the late 19th C. It was during this period that the art of taxidermy reached its pinnacle. The taxidermy is the work of one man, Edward Hart, supported by his wife who is credited with painting the case interiors which depict local scenes where the birds were collected. Hart kept detailed notes about where and when the specimens were collected, mostly in the Hampshire / Dorset area of southern England.

There are lessons to be learned from the collection's history. The collection was large enough for Edward Hart to open and run his own museum which was very popular. Shortly before Hart's death, in 1928, the collection was sold to a private enthusiast on whose death it went to a private school and became neglected. It was loaned to Leicester Museum which provided safe storage and curators there began to promote the importance and quality of the collection. The school retained ownership and sold the collection in the mid 1980s. Most of the cases were purchased by the Horniman Museum which is now bringing the collection and associated environmental data to wider audiences. The single most important lesson to be learned from the chequered history of the Hart Collection is that use and public access are fundamental to the sustainability of museum collections.

Dead and dangerous! Managing contaminated taxidermy specimens

Henry, D.A.
Museum Victoria, GPO Box 666 Melbourne, Victoria, Australia. 3001

In November 2009, Museum Victoria opened *Wild: Amazing animals in a changing world,* which features more than 750 vertebrate animals from around the world. While the presence of residual heavy metals is well-documented in zoological collections, the development of the *Wild* exhibition highlighted problems in managing this issue across the Museum. Specimens were 'handled' by a variety of staff groups, including collection managers, conservators, preparators , designers, installers and photographers, often in the absence of detailed risk assessments for the activities to be undertaken. Staff attitudes to the issue varied widely and some were unacceptably exposed to contaminants. It was apparent that the Museum had not managed all the inherent risks. This placed staff at risk and the Museum potentially in breach of the Occupational Health and Safety legislation.

In addressing the issues, experts in hazardous substance were consulted and a variety of testing regimes implemented. This included XRF testing of specimens. Air and surface monitoring was conducted within collection stores, laboratories and the gallery. Staff from several work groups were tested for relevant toxins.

The outcomes of this process include:

- A changed culture of approach to the management of hazards and risks to staff
- a better understanding of the risks associated with contaminated specimens
- instituting a health and safety risk management framework to the management of hazardous substances in collections
- applying the mandated hierarchy of controls to treating the risks, including providing a dedicated workspace for interventionist work on contaminated specimens
- improving the culture of seeking expert external and internal advice
- improving documented procedures for the handling and treatment of contaminated specimens and
- developing better communication and training across the Museum.

Deploying CollectionSpace at UC Berkeley – a community source collection management system for the future of museums at Berkeley

Hoffman, C.R., Doran, A.S.
University of California, Berkeley, CA 94720

UC Berkeley has selected CollectionSpace as the strategic platform for museum collections across campus due to its modular design, its capacity for customization and interoperability, its flexible hosting requirements, and most importantly its ability to support collections-based research, education, and public service. In this presentation, we will provide an update on the CollectionSpace project (software development and sustainability planning) and projects at UC Berkeley to deploy the software for campus museums, including two members of the Berkeley Natural History Museums consortium. Changing digitization methods often means changing workflows, and data capture is now often performed from digital images with only partial information being captured at the time of imaging. We will demonstrate workflows for rapid data capture from herbarium specimen sheets, based on work for an NSF-funded project to digitize a large collection of Pacific coast seaweeds in the University & Jepson Herbaria. The Berkeley Natural History Museums are working together with the CollectionSpace project to grow a community of natural history collections by writing templates and documentation that will help other collections deploy CollectionSpace. More information is available at http://www.collectionspace.org.

Natural history collections, an essential resource for building interactive bee identification guides

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Discover Life is an on-line interactive encyclopedia of life dedicated to assembling and distributing natural history information with over one million species pages. A primary function of Discover Life is the development of web-based identification guides that can be geographically and taxonomically tailored to fit the needs of users. Discover Life provides free tools to identify species of specific groups of organisms, build distribution maps from geo-referenced specimens, store and process images, track environmental and ecological factors, and augment environmental education courses. The main sources for building Discover Life identification guides are natural history research collections and taxonomic literature. They provide the source material to capture geographical distribution, morphological variation and subtle differences between species. Interactive web-based guides expand upon traditional dichotomous keys with distinct advantages, including increased portability and accessibility, selection among multiple character states to minimize both developer and user error, and a species list that changes as characters are selected. Identification guides have been made for the ~900 bee species found east of the Mississippi. Currently these guides are being expanded to include the ~3500 species of bees found in North America north of Mexico. This talk presents an overview of the process involved in creating interactive identification guides for the bees of North America north of Mexico. Bees are among the main pollinators of plants in most ecosystems and given the recent concerns about their population declines, these guides will allow museum personnel, conservation biologists, pollination providers and researchers to reliably identify bees and access species pages (http://www.discoverlife.org/).

Daubenton-Leonardo: Alternative funding for collections management training

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Natural history institutions across the world aim to extend the use of best practice. Staff development plays a vital role in this and in 2007 the Natural History Museum, London and the Museum national d'Histoire Naturelle, Paris set up a programme to allow collections management staff to benefit from the sort of collaboration undertaken by researchers, i.e. through working alongside colleagues in their sister institution. A series of institution-funded staff exchanges and seminars was set up as 'Project Daubenton'. The benefits soon became apparent and other European institutions were keen to engage but institutional funding alone

was not sufficient to enable this. Funding to support collections management projects can be found in less obvious places. In this case it was the EU Lifelong Learning programme. It aims to contribute to an EU goal '*to become an advanced knowledge based society with sustainable economic development, more and better jobs and greater social cohesion*'. It supports this through promoting the exchange of best practice, co-operation and mobility within the EU, while respecting national diversity. Leonardo is part of this, run at national level and providing vocational education and training.

A number of institutions in Belgium, France, UK and Sweden successfully applied for funding. So far more than 30 staff have participated resulting in improved working practice and communication between European collection managers. The success of this model is encouraging further collaboration within Europe and beyond. The programme is an example of trans-national cooperation attracting unexpected funding to deliver development opportunities for collections managers worldwide.

Removing the barriers to molecular access to collections

Huxley, R., Maldar, G.J.
Natural History Museum, Cromwell Road, London, SW7 5BD. UK

The demand by the research community for extraction of DNA from museum and herbarium specimens has increased dramatically over the last 10 years and new technologies are improving success rates. However users remain frustrated in their attempts to use collections. Not only is DNA not readily accessible due to degradation resulting from age and storage conditions, but the specimens may be so rare or vulnerable that collections managers are understandably reluctant to allow destructive sampling when there is limited likelihood of successful recovery of DNA. There are also barriers to extraction presented by other cell products such as secondary metabolites in herbarium specimens and muco-polysaccharides in some invertebrate tissues that mask DNA.

The Joint Research Activities of the SYNTHESYS project are a pan –European research effort to remove these barriers to access.

Three of these activities aim to facilitate the dialogue between research and collections staff by reducing the need for unnecessary sampling of collections. They are:

- A non-invasive software tool to predict the chances of successful extraction of DNA from collections that predicts decay based on the environmental history of specimen
- An investigation into the feasibility of creating DNA libraries to minimise intervention and reduce the need for repeat sampling of critical specimens
- A system for reducing the impact on specimens by using microsampling methods in ancient DNA extraction from osteological specimens

A further two activities are addressing the problems specific to herbarium and muco-polysaccharide rich material that interferes with successful extraction

The results and protocols developed by these activities will be fed into European standards and policy making decisions in line with the overall aim of the SYNTHSEYS project; to increase access to natural history collections across Europe.

The Arctos/TACC Collaboration: Shared digital preservation and access

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The Arctos database consortium and the Texas Advanced Computing Center are collaborating to provide a highly reliable, high-performance production infrastructure for managing and electronically publishing catalog data, images, audio recordings, and other digital media for over 1.3 million specimens from multiple institutions. Multi-system, multi-location data replication ensures that no data are ever lost. Simple workflows for the ingestion of new media include automatic generation of derivative files such as thumbnail images, and tools to link new media uploads to specimen records. This infrastructure provides powerful capabilities with a low learning curve, thus enabling curatorial staff to focus on digitizing and cataloging specimens rather than on data management, preservation, and web development. Scalable and shared facilities show the

potential for collaboration between institutions focused on cyberinfrastructure and institutions hosting natural history collections, thereby easing the adoption of cutting-edge technology and lowering the cost of collections digitization and management. Such collaborations enable longterm sustainability for data access and preservation.

Museum emergency preparedness and response specifically against earthquakes: A literature review

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There is a significant body of literature in both Japanese and English related to disaster preparedness and response that has been developed primarily by or for museums and similar cultural institutions. The main focus of most of these works is on earthquake damage prevention and rescue guidelines aimed at protecting people, museum collections, properties, and facilities. The recent magnitude 9 earthquake, resultant tsunami, and continuing aftershocks in Japan, and the potential for similar events in the United States and elsewhere in the world, make this topic timely and urgent. Since the extent of the damage is still unknown, it is still too early to assess the effectiveness of emergency plans, risk assessments, preventive measures and drills that had been in place in institutions in Miyagi, Iwate, Fukushima, Ibaraki, Chiba, and Tokyo.

The discussion is intended to heighten awareness once again about the importance of emergency preparedness and provide an opportunity to reflect upon your institution's existing emergency plans. Even in areas not prone to earthquakes, it is best to have such plans in place, because there are many types of possible disasters that can affect museum collections.

Assessing your collections management

Maldar, G.J., Huxley, R.
Natural History Museum, Cromwell Road, London, SW7 5BD. UK

The EU funded SYNTHESYS project museum collections surveyed collections management in 15 major institutions using a panel of external experts. Feedback on the process was positive; with many institutions using the results to improve internal procedures or to obtain additional funding for collections management. There was a huge demand for more of these assessments by the community but this was a very labour intensive activity.

SYNTHESYS has now developed a simple to use, online self-assessment form. The system allows an institution to self-assess at the level most appropriate to their collections and available resources, be that institutional or departmental. The survey covers all areas impacting on collections from budget allocations, staff expertise to use of materials.

Institutions complete an on-line questionnaire on how they manage their collections, the answers are then reviewed based on a risk factor and a report is produced. This report highlights the areas that need immediate attention to ensure the longevity of the collections. It also includes advice on non-urgent areas of potential development and provides resources that could be used to improve the collections management and ensure that the collections remain accessible.

In order to ensure consistency of the results an efficient audit system exists to validate the results of the self-assessments. This will involve two members of SYNTHESYS visiting the institution to validate results. Not all institutions completing the self-assessment will be audited. Institutions will be selected at random.

The use of the survey tool is not limited to European institutions, and SYNTHESYS is keen to see global utilisation.

The Nevada State Museum, Carson City - A case study on the curation of federal collections.

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Nevada State Museum, 600 North Carson Street, Carson City, NV 89701

The 1966 National Historic Preservation Act required collection and curation of cultural resource management (CRM) collections. The Nevada State Museum began accepting these archaeological collections in the 1970s. Acceptance of CRM collections resulted in various issues ranging from a shortage of storage space, short-sighted financial planning, and inadequate long term conservation of collections and associated documentation. Our museum's experience in curating CRM collections provides other institutions with a case study that not only applies to archaeological repositories but also for paleontology departments. The Omnibus Public

Land Management Act of 2009, states that the Secretary of the Interior shall manage and protect paleontological resources on federal land and that these resources shall be deposited in an approved repository. The Nevada State Museum has already received and accepted small paleontological collections because of increased agency awareness of paleontological resources. The curation of Pleistocene megafauna, however, may prove problematic for our institution.

Sustainable furniture for sustaining collections

Martin, G.
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Collections furniture such as cabinets and drawers are an essential component of any museum's collection. Poor quality furniture poses a considerable conservation risk and may also limit the accessibility of the collection. However replacement of furniture is costly and is seen as a low priority by many museums.

The Entomology collection at the Natural History Museum, London has approximately 120,000 drawers of pinned insects which contain 28,000,000 specimens, 279,000 of which are Type specimens. Historically the collection was housed in a variety of cork-lined drawers in both open and closed wooden cabinets. As well as being exposed to pests, the drawers were affected by fluctuations in temperature and humidity. This was having a deleterious affect on the collection and so over the last 10 years there has been an active programme to rehouse the entire collection. The collection is being moved into drawers with plastazote-lined unit trays, within pest proof metal cabinets. Over half of the collection has been transferred so far with the main limiting factor for rehousing specimens being funds to purchase new drawers.

Most of this work has been financed by the sale of redundant collections furniture mostly to individuals (eBay has proved invaluable!). To keep the costs down further we have developed a refurbishment programme for existing drawers to be modified to meet modern curatorial standards. This costs a quarter of the price of a new drawer.

The talk will discuss logistics of the collections rehousing, the drawer refurbishment scheme and how this has considerably benefited the long term sustainability of this very important collection.

The history of the Field Museum's Geology Department - Fossil Invertebrates Division: How annual reports and museum bulletins can enhance knowledge of collections

Mayer, P. S.
Field Museum of Natural History, 1400 S Lake Shore Drive, Chicago, IL 60605

The Field Museum's fossil invertebrate collection started with the purchase of 5,000 fossils exhibited in 1893 at the Columbian World's Exposition. Since that time the collection has grown to over two million specimens. Intertwined with these fossils is the history of the seven curators, eleven collections managers, other staff members and volunteers who have collected, researched, and cared for them.

I examined a variety of Field Museum publications while researching the history of the Fossil Invertebrates Division for a new web page (http://fieldmuseum.org/explore/department/geology/fossil-invertebrates/history). I uncovered information and photos about the collections that restored some long forgotten institutional memories.

For example, the label for a collection of uncataloged Permian brachiopods states: "Temporary Label, *Linoproductus lineatus* (Waagen), Group 4, Salt Range of Punjab". I learned from annual reports that curator S. K. Roy was called up by the U.S. Army and stationed in the India-Burma Theater during World War II. In 1945 he was granted a one-month leave from the army to collect geologic specimens from the Salt Range in Punjab, India (Pakistan). Included in the 1948 annual report is a photo of curator E. S. Richardson Jr. making preliminary identifications of these fossils. From the annual reports I learned who collected these fossils, when they were collected, and who made the identifications.

This is one example of many that demonstrates the value of securing information about your collection to future collections managers. It also exemplifies the significance of annual reports and other publications as a source of information about collections.

When it all goes wrong – the development of an entomological salvage plan

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The theme for this year's SPNHC conference is sustainability. However, what happens when things go wrong? Museums are the repositories for the majority of the world's biological heritage and as such we have an enormous responsibility to look after them. For the majority of the time, collections are maintained and enhanced to a sustainable level. However, disasters happen, often through no fault of the individual museums, with examples including fire, floods and war!

Recently the entomological collections of The Natural History Museum moved into a new building specifically designed to provide optimal storage of the pinned and slide collections (some 20 million entomological specimens and a further 10 million plant specimens). We have taken the opportunity to develop a new format of salvage plan for the entomology collections. In this talk we briefly discuss the history of salvage plans (both at the NHM and other museums across the globe), our efforts to produce a working document that is useful in a disaster scenario, and what we have learnt from previous salvage events (both positive and negative). We feel reasonably confident about salvage procedures for many types of insect specimens but need to develop our plan in relation to slides and spirit material. The next step is to set fire to drawers of insect specimens to learn more about the effects of fire on different storage media (e.g. cork and plastazote). We will discuss some of the potential conflict between optimal standards of curation and salvage needs, in relation to the deterioration of glues, cardboard, etc. And further, what we have learnt in terms of collections management about storage, space issues, curation and staff in the process of developing a new plan for the Entomology Department and how it fits in with the overall Museum disaster plan.

Collection network - the best source of **information on invasive alien plants**

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Collections are maintained and resourced in part because they are useful. The principal use is in providing information. The value of this, especially at the level of a network, is inadequately dealt with in the various texts on the role of collections. How valuable is the collection network in providing information urgently and widely needed to deal with environmental problems? We defined the collection network as "a group of 30 Canadian herbaria. We then explored the value of this network compared to other sources with respect to four questions regarding invasive alien plants: Where has Sea Buckthorn escaped in Canada? Where could Sea Buckthorn escape in Canada based on locations where it is presently cultivated? What is the distribution of the rapidly spreading European Common Reed in Canada based on a map? Will Scotch Broom be as serious a threat to the natural environment in other parts of Canada outside of British Columbia.

Sources used to provide answers to these questions included (in addition to the herbarium network): the web, conservation data centres, provincial natural resources departments, botanical gardens, invasive plant councils, nature clubs, agricultural research stations and others. Information acquired from different sources varied in depth, return time, amount, and according to the nature of the question. The fact that the information from collections was usually accurate, specific and represented a sample of effort over a long time period enables an extraordinary role in providing data. The results suggest strongly that a collection network can be the very best source of information on certain important ecological questions.

Robust computational photography techniques for collections conservation, research, and public access

Mudge, M., Schroer, C., Lum, M.
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This talk will present highlights of the principles and practices for robust photography-based digital techniques for collections conservation, research, and public access. Examples of existing and cutting-edge uses of photography-based imaging will be presented, including Reflectance Transformation Imaging (RTI), Algorithmic Rendering (AR), camera calibration, and methods of imaged-based generation of textured 3D geometry. Adoption of these technologies in the museum community is growing.

These practices are part of the emerging science known as Computational Photography. This imaging family's common feature is the purpose-

driven selective extraction of information from sequences of standard digital photographs. The information is extracted from the photographic sequences by computer algorithms. The extracted information is then integrated into new digital representations containing information not present in the original photographs, examined either alone or sequentially.

The most mature and widely adopted technique for collections conservation and research is Reflectance Transformation Imaging. RTI creates digital representations from image sequences where light is projected from different directions. All the lighting information from this image set is mathematically synthesized into an RTI image, enabling a user to interactively re-light and enhance the subject's surface in incredible detail.

The talk will examine how these empirical acquisition technologies can generate scientifically reliable digital representations that enable future reuse for novel purposes, assist the long-term digital preservation of the digital representation, aid the physical conservation of the digitally represented museum materials, and enable public access and research.

Integrating taxonomic institutions in Europe: lessons learned from the five year project EDIT

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The EU project EDIT (European Distributed Institute of Taxonomy, 2006-2011) aimed at bringing together taxonomic institutions in Europe that for historical reasons have developed independently. Durable integration was one of the overall objectives of this "network of excellence", approached in the broadest sense. For this end 28 leading institutions in Europe worked towards integration and harmonization of their scientific activities, information technologies, physical infrastructures, and research plans. As the result, EDIT initiated a number of different joint activities that have been established successfully in the life time of the project and are now being maintained, e.g.:

- Technical working groups such as the Information Science and Technology Committee linking IST departments and guiding informatics integration and development, and a Collection Policy Board bringing together directors/heads of collections to work towards common collection management principles and policies;
- New online tools such as the Platform for Cybertaxonomy (http://wp5.e-taxonomy.eu/platform/), Scratchpads (http://scratchpads.eu/), and a European e-Journal for Taxonomy to build, share, and publish information on biodiversity;
- All Taxa Biodiversity Inventory + Monitoring (ATBI+M) program and task force (http://www.atbi.eu) to provide taxonomic expertise for conservation areas in their efforts to record and document local biodiversity;
- A Distributed European School of Taxonomy to transfer knowledge to new generations of taxonomists through dedicated training courses.

EDIT revealed both, the need and the interest in closer co-operation and harmonization between taxonomic institutions. Even though the step from project based, short-term activities to long-term perspectives and decision-taking on higher management level takes longer than the life time of a project, EDIT took a first step also on the strategic level, and provides valuable examples for the process of integration of larger taxonomic institutions in Europe.

Using herbarium specimens as a means of determining change over time

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The study of change requires two kinds of data: current and historic. However, historic data either already exists, or it doesn't; and, where it does exist, it may not be in a useable form. For more than 200 years, botanists have been collecting plant specimens to document floral biodiversity. Digitization has made it possible to quickly assemble data from these historic records. But what is the potential of 60 million historic plant records - in herbaria across the United States - to contribute to change studies? Plant specimen data from the San Jacinto and Santa Rosa mountains in Riverside County, CA were assembled from 14 different herbaria. These specimens documented more than 100 years of collecting events. Our question addresses how useful are herbarium specimens in documenting changes in plant species composition

during the 20th century. Our methodology is clearly outlined, and initial results are presented. The longer term value of these kinds of data in supporting the development of land management policies and informing education in both formal and informal environments is mentioned as a segue into the following presentation.

The Field Book Project

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The Field Book Project is a collaborative project for improving access to primary source materials related to biodiversity research. Led by the US National Herbarium and Smithsonian Institution Archives, this project is developing a Field Book Registry based on existing standards and community input. In this presentation, we will introduce the project in terms of envisioned benefits for the collections community, current implementation status, and future goals.

Field books are the original documents that describe the events and circumstances leading up to and including the collection and description of biological specimens. The Smithsonian houses thousands of these unpublished journals, notes, and images. But for most of these, little documentation exists. Funded by the Council on Library and Information Resources (CLIR), the Field Book Project is currently focused on describing, cataloging and providing access to item records. We will present on the status of achieving these immediate goals as well as our longer term goals of extending functionality and expanding the scope of the Registry.

Longer term goals focus on making field books accessible via a public-facing, online Field Book Registry that will serve as an international toolkit for management of biodiversity field books. In this second phase of the project other organizations will be able to contribute their field book content. This collaborative effort is still being defined with partner institutions including Harvard University Herbaria and Archives, Peabody Museum (Harvard), New York Botanical Garden, Academy of Natural Sciences, Missouri Botanical Garden, and California Academy of Sciences. Page level digitization and delivery is another long term objective. Working with the Biodiversity Heritage Library (BHL) we are assessing possible strategies for accomplishing this monumental task.

More information is available on the project website http://www.mnh.si.edu/rc/fieldbooks/ and through an active blog http://nmnh.typepad.com/fieldbooks/.

The zoological wet collections of the Museum of Natural History Berlin: Recent improvements in collection management and storage

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The zoological wet collections of the Museum of Natural History Berlin comprise specimens in more than 233,000 jars filled with 80 tons of ethanol; and were collected over a span of more than 200 years. Within the framework of the KUR-Programme for the Conservation of Moveable Cultural Assets, our activities focus on (1) improving collection management via input from experts within and outside Germany, (2) conducting a profile of the wet collection derived from the Smithsonian Collections Profiling System, (3) improving the storage of specimens by placing them into more suitable containers such as borosilicate ground-glass stopper jars (for type material, extinct species) and twist-off jars (for less valuable material) and (4) applying archival standards for the removal, re-gluing and storage of labels including staff training. In addition, efforts were made to evaluate various ideas about long-term data storage using different kinds of “labels” such as transponders, laser-encrypting glass jars and paper. A gaschromatographic and mass spectrometric analysis of the denaturing agents in the conservation fluid revealed typically 3-4, but up to 7, different agents per jar. The wet collections have recently moved into new storage facilities in the rebuilt east wing, which was in ruins for more than 60 years. This building is specifically designed for housing the ethanol collection with a controlled temperature regime of 18°C +3°C and a gas-based fire extinguishing system. The ground floor of this new building is open to the public at certain times.

The Consortium of Pacific Herbaria: A new research and collections network for Oceania

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The Pacific Basin includes some 5,350 native species of vascular plants, of which approximately 57% are endemic, and at least 565 species of benthic marine algae. Unfortunately, it many taxa are presumed extinct and the survival of others is gravely imperiled. The Consortium of Pacific Herbaria (CPH) was established recently to facilitate communication about regional plant and algal biodiversity. The CPH is a collaboration between the Bishop Museum, University of Hawaii at Manoa, National Tropical Botanical Garden, and eleven herbaria located in Hawaii, American Samoa, Samoa, Tonga, Palau, Guam, and Fiji. The major goals of the CPH are to curate, georeference, database, and digitally image over a half a million dried vascular plant and algal specimens from the Polynesia-Micronesia biodiversity hotspot. Data from some of the smaller collections have been unavailable electronically and thus essentially inaccessible to the wider community. The CPH will use a standardized list of accepted names that reflects a general taxonomic consensus concerning familial and generic limits; this in turn will assist the many regional stakeholders who rely on current taxonomic, ecological, and distributional data of plants. The collections data and digital images will be available from a web portal housed at the University of Hawaii at Manoa. The availability of digital data through the CPH will create new opportunities for researchers, educators, and citizen scientists to discover and use collection data by species, geographical area, and institution.

Digitally enabled engineered reconstruction of a baby Apatosaurus

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Engineers in collaboration with paleontologists from the Sam Noble Oklahoma Museum of Natural History are working towards reconstructing the anatomy of missing bones of a baby apatosaurus using reverse engineering and rapid prototyping tools. With approximately 15% of the bones collected, scientists have explored innovative techniques to reconstruct the 292 bone juvenile skeletal structure. This presentation will address four digitally enabled techniques to reconstruct the skeletal structure. First, existing bones were laser scanned to obtain point cloud data that was reconstructed to obtain virtual models for the excavated bones. Second, we utilized a large object 3D Scanner to scan an adult structure that was on exhibit, collecting over 50 million points that was later resized for the juvenile structure. Third, existing sketches of the bone structure were used to reconstruct 3D models using a force-feedback device from virtual clay. In the fourth technique, models were built from clay and scanned in to obtain the 3D model and then assembled to obtain a complete highly detailed virtual model of the baby Apatosaurus. After digital reconstruction, the bones were rapid prototyped to produce the master patterns and then the molds to obtain the desired bone structure. Unlike traditional skeletal reconstruction methods, the use of digital design/manufacturing tools has tremendously cut the time and complexity involved in the reconstruction process. Each method allows for all of the 292 juvenile apatosaurus bones to be assembled together more efficiently, in less time and with fewer volunteers.

Managing expectations: Defining collections requirements at a university natural history museum

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Appropriate collections care includes examining the future; financial, space, staffing, and use requirements. Most often, natural history museum professionals focus on the current collections and how to improve existing conditions. New programs, such as the American Association of Museums: Center for the Future of Museums, have begun to promote and educate museums on the intricacies of planning for the future. The Yale Peabody Museum of Natural History is again working

on a master plan looking at the next ten to fifteen years of activity within the museum. The master plan explores the overall requirements for the museum, a portion of which focuses on the collections. The collections planning process, as we will discuss, includes; assessing growth, changes in frequency and reasons for collections use, technological and cabinetry advances, space allocation, funding, and potential resource sharing between institutions. As a university natural history museum specific considerations are faculty use and research, teaching and student needs, and how these impact collections growth. Incorporating a comprehensive list of requirements into collections planning is imperative to adequately maintain scientifically valuable and accessible collections.

Abstracts for DemoCamp Presentations

Recent advances in SALIX, a semiautomatic label information extraction system using OCR

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The use of optical character recognition (OCR) software to read label data, coupled with software to transfer those data into a database has been a goal in recent years. If the process of extracting data from specimens could become automated or partially automated, then the process of databasing numerous specimens held in herbaria could be greatly accelerated. We believe that full automation may be impossible due to the variability in label format and quality; there will always be a need for some manual verification and editing. SALIX was developed by Lafferty to meet the data processing needs at the ASU herbarium. This program includes tesseract, an open source OCR program, but label images can also be batch processed using the propriety OCR software ABBYY FineReader 10. This system will recognize print and convert it to text with significantly better results than tesseract, with the added bonus of being fully automatic. We have used this system and have improved it to the point where it has become a practical alternative to typing. When OCR results are good and the labels are information-rich, we believe SALIX is faster than typing. All the processing is in the control of the operator and the necessary equipment and software are relatively inexpensive. A moderately priced digital camera and SALIX are all that are needed. SALIX automatically parses the OCR text to a database while the user facilitates the process, so mistakes can be corrected immediately. As SALIX is used, it gathers statistics on the words that are most likely to belong in a certain field, thereby improving its parsing accuracy.

Specify 6 SGR-- Scatter, Gather, Reconcile

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Accepted curatorial practice within some biological collection disciplines includes the distribution of specimen duplicates to multiple institutions as a way to share knowledge about organisms, obtain identifications from specialists, repatriate vouchers to host countries, and help ensure the survivability of specimen vouchers.

This historical duplication of specimens and their associated data creates an opportunity to leverage prior investments in data entry by re-using information already computerized for the same specimen collection. In 2007, with NSF-funding (BRC 0138621), the Mex@MICH Project sought to computerize the data from specimens of Mexican plants held in the University of Michigan Herbarium. The project tested the efficiency of three workflows to minimize data entry cost and to leverage existing digital data [Taxon 59(6): 1830-1842].

The SGR Project will implement software functions within Specify to further generalize and automate the process for use by other projects and collections (BRC 0968352).

The SGR workflow will use partially-completed specimen database records to search online specimen database caches for duplicates. Matching records are discovered and ranked by goodness of match. A Specify 6 user interface will allow comparison of the focal record with matching records from duplicates, and enable interactive editing of matching records to assemble complete database records for local specimens with little or no additional data entry.

This Specify demonstration will highlight the effectiveness of the SGR workflow for rapid discovery and assembly of specimen. SGR workflow functions will be available within Specify 6 in 2011.

The Apiary Project - A framework and workflow for extraction and parsing of herbarium specimen data

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Millions of specimens in herbaria worldwide need to be digitized to be accessible to scientists. A key challenge faced by biodiversity collections is determining a transformation process that yields high-quality results in a cost- and time-efficient manner. The University of North Texas's Texas Center for Digital Knowledge (TxCDK) and the Botanical Research Institute of Texas (BRIT) are developing a web-based application workflow for combining human and machine processes to facilitate the transformation of herbarium label data into machine-processable parsed data. The workflow and framework, called the Apiary Project (www.apiaryproject.org), are made possible through integration of existing technologies and metadata standards. The workflow interfaces allow human participants to inspect and analyze digital images, extract text, and then parse this text into standardized metadata elements.

Apiary's web-based interface is designed for use by the general public, with minimal training, allowing collection managers and curators to assemble resources to meet the challenge of effectively and efficiently extracting data from images. Apiary can be integrated into existing and future workflows to speed the process of digitization and data mobilization. Apiary is built with open source components (including Fedora Repository, Islandora, Drupal, djatoka image server and OCRopus) and is in the final phases of development and testing prior to the release of version 1.0 which will be available under an open-source license.

The Apiary Project is funded by a National Leadership Grant (LG-06-08-0079) from the U.S. Federal Institute of Museum and Library Services.

Building specimen-data curation pipelines using Kepler workflow technology in a Filtered Push network

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The Filtered Push (FP) project aims to improve the quality of natural science collections data by directing assertions about data quality from consumers back to curators of the original distributed datasets and other interested parties. We demonstrate how data curation processes in an FP network can be automated and simplified by building *curation pipelines* with actors from the curation package of the Kepler workflow system. Our curation workflow imports a to-be-cleaned specimen dataset from a spreadsheet, database or FP network. Diverse services and tools are integrated through the workflow actors, helping data curation in different dimensions: using visualization services (e.g., Google Maps), which show specific data distribution patterns, the quality problems is easily spotted. To correct the problems, curation operations are introduced; e.g., taxon names are normalized through name authority services like IPNI. Duplicated herbarium specimen records, are automatically identified and curated through data clustering and fusion. The original and fused records are imported into a Google spreadsheet. The appropriate curator is directed by email to this spreadsheet for confirmation or further editing. Finally, the workflow compiles all relevant information as a synthesis of proposed changes and remaining problems etc. Interested parties can assess the credibility of assembled curated data through examination of the data lineage in a provenance browser, which can show curatorial changes made by each curator or software agent.

Arctos: A collaborative collection management information system

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Arctos (http://arctos.database.museum) is a collaborative, web-based collection management information system that currently serves data on over 1.3M records from 37 collections at 8 institutions. Arctos integrates access to diverse types of natural history collections (paleontology, entomology, herbaria, ornithology, mammalogy, herpetology) and data types, including specimens, observations, tissues, parasites, stomach contents, field notes and media such as photographs and audio recordings. Key features include collection-management and object tracking (e.g., barcoding) applications, tools and services for data visualization and mapping, and partnerships with external web resources (e.g., GenBank, Texas Advanced Computing Center) to link specimens with associated data and media. In addition, users can easily track collection-related accessions, loans, and publications that are tied to a specific project (e.g., Ph.D. research, National Park Service surveys and resurveys). Arctos code is open, and users form a strong community that contribute to data standards, application enhancements, and improved data quality through sharing of authorities for taxonomy, geography, people names, part types, and other data. New developments underway include dynamic linking of field notes and images to associated specimen or observational records, which will enable discovery of hidden data and provide a robust means for validating georeferenced localities. The web-based, integrated, collaborative, cost-efficient, and cross-disciplinary features of Arctos make it unique and well-suited for natural history collections of all sizes and types. We will demonstrate the key features of Arctos and briefly discuss potential new developments.

The MCZ's ImageCapture application for supporting an efficient data capture workflow in entomological collections

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Large insects, especially those with wings, like butterflies and moths, represent one of the most intractable problems for digital capture of legacy paper records in natural science collections. Disciplinary practice has been to mount specimens on pins with data present only on labels on the pins beneath the specimen. Physical handling of the specimens and labels is necessary to capture and mobilize such data. In the Entomology Department at the Museum of Comparative Zoology, we developed a workflow and supporting software to efficiently capture the data of the more than 200,000 specimens in the butterfly collection to separate specimen handling from data capture by using images (described at SPNHC 2010). The rate limiting step in this process is not sorting and checking identifications (ca. 1 minute per specimen) nor handling and imaging specimens (ca. 1 minute per specimen, using carefully selected personnel and conservation protocols). The bottleneck is transcription of collecting event and locality data from the pin labels. We have addressed this rate limiting step by developing a web application for community sourcing the transcription, whereby label interpretation is provided by a broader entomological community with specialist knowledge.

We will demonstrate the software we developed for this workflow, including the production of barcode labels that encode data about the specimens derived from the physical organization of the collection (such as current identification and collection) for inclusion in images; the software that reads the barcode content from the images and produces a database record; and the community sourcing application that allows knowledgeable members of the community to transcribe label data. This software is being shepherded through the university's technology office for release under an open source license. This software most notably differs from Apiary and Salix by combining barcode reading and human transcription rather than OCR, parsing, and human transcription.

Reflectance Transformation Imaging (RTI) for empirical documentation of natural history collections

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Reflectance Transformation Imaging (RTI) has the potential to revolutionize documentation, treatment, and research of museum collections, while also promoting the integration of interactive images into the visitor experience. RTI enables museum professionals to examine an object's very fine surface details using basic digital camera equipment. Sophisticated open-source software allows conservators, collections managers, curators, and other museum staff to generate images that meet specific needs, using mathematical enhancements and display software to bring out intricate surface details not visible with the naked eye or with traditional magnification. Image capture and processing metadata are automatically packaged with the RTI pictures enabling the automatic generation of process-history provenance logs. These 'lab notebooks' record the means and circumstances surrounding the creation of the digital representation, a necessary element for scientific evaluation and the use and reuse of data for novel purposes by others in the future. Metadata management is kept 'under the hood', so the user can attend to the job at hand. Through the Internet, individuals and communities can come together to interactively explore this knowledge and uncover new ways to understand our world.

We will outline the inexpensive and easy to learn image capture methodology and image processing open source software. We will demonstrate examples of the resulting RTI images using the RTIViewer, viewing and analysis tool. RTI is part of a family of related methods, often called Computational Photography, based on the extraction of information from multiple digital photographs. The software tools are developed by an international collaboration of research labs and universities. RTI has already been deployed and adopted by several leading museums in the US and around the world.

Overview of the GEOLocate web application

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The vast number of collection records in need of georeferencing and verification requires human resources beyond that which the natural history collections community alone can deliver using traditional approaches for georeferencing. The goal of the GEOLocate project is to overcome this impediment through intelligent workflows, software and services for automated georeferencing, validation and verification of specimen occurrence data. This submission will provide a demonstration of the GEOLocate web application interfaces for single-record, batch & collaborative georeferencing with a preview of an interface for taxon-based validation. Support for this project is provided by the U.S. National Science Foundation.

Abstracts for Posters

The value of ancillary collections: A justification for their preservation, organization and digitization

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Most natural history collections have associated ancillary material, including field notebooks, correspondence, manuscripts, original drawings, photographs, and even personal effects of collection associates. These unique items can contain detailed specimen information not replicated in databases or specimen labels and provide a historical context for collections. Unfortunately, ancillary collections often suffer from a lack of resources that leaves them unrecognized, disorganized, and in danger of loss. At the University of Iowa (UI) Paleontology Repository, ancillary collections salvaged from academic departments have been organized into a Paleontology Repository Archive. The effort and cost is proving worthwhile. The Archive has helped rediscover and strengthen a connection between collections from a 1922 expedition that were scattered across the UI campus; helped solve a transatlantic paleobotany mystery; helped identify specimens of historic interest; provided material for several websites and teaching resources; and provided research material for a "history of the collections" project funded by the State Historical Society of Iowa.

The ongoing archive project relies on collaboration with the UI Museum Studies Program and UI Libraries. Museum Studies students who want archive and preservation experience, organize and house materials, create finding aids and select projects for digitization and web exhibits with advice from the UI Archivist. The UI Libraries Preservation and Conservation Department conserves and digitizes field notebooks, journals, photo albums and personal specimen catalogues and provides student training in basic paper cleaning and repair. The UI Libraries also facilitates contributions to the Iowa Digital Library, including providing CONTENTdm software, training and instructions for recording digital image metadata, following digitization standards, and image processing, as well as personnel support.

Trouble in the Gallery: Balancing displays needs with conservation requirements to provide a sustainable solution to building based environmental problems at the Natural History Museum, London

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The Marine Reptile Gallery at the Natural History Museum, London contains 78 specimens that have been mounted on the gallery wall since the 1920's. They represent the most comprehensive collection of Lower Jurassic fossil marine reptiles on display in any museum.

In 2009, mold was observed on three specimens displayed in the gallery along with an infestation of book lice and plaster beetle on a further 9 specimens. Two of these specimens had pyrite oxidation serious enough to present the risk of them falling from the gallery wall. Working with the Design and Installation Team, the Conservation Unit at the Natural History Museum started a program to resolve what turned out to be a long-standing problem of moisture migration through a south facing wall.

Environmental monitoring on the external wall and at the back and fronts of the specimens showed that exterior temperature of the wall remained very close to dew-point, leading to saturation of the single-block wall. The listed status of the Waterhouse Building meant that it was impossible to undertake any major building work, so non-invasive solutions to the problem had to be put in place to effectively resolve what proved to be a long-standing building issue.

The size of the specimens, the need to work in a gallery space regularly booked for public and private events and the nature of the deterioration presented serious problems for the conservation team. The project is reviewed and the simple and sustainable resolutions to the problems discussed.

What's ahead: Using a general survey as a planning tool

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The Carnegie Museum of Natural History last conducted a general survey in 1989 funded by IMLS Conservation Projects. It was one of the first major natural history museums to do so, using the survey report as the foundation for the museum's first comprehensive long-range conservation plan. This plan guided conservation efforts for the past 20 years.

Conservation has consistently remained a cornerstone for collections care at CMNH. Priorities laid out in the long-range plan have guided preservation activities at both the institutional and individual collections level. Renovations to numerous exhibit halls and storage areas have been completed, including improvements to storage equipment and mechanical systems. Conservation, as a department, was moved out of the Section of Anthropology to become a section unto its self. However, these have changes have been implemented without updating the long-range conservation plan. There have also been changes in administration and conservation staff.

With the hiring of a conservator in 2009, it was determined that the most efficient and effective way to assess the success of past preservation efforts and determine the future direction for conservation at CMNH was to conduct a new general survey.

The survey was developed and implemented as a collaborative effort between museum representatives and external specialists. The goal of the survey is to provide the primary assessment of current risk to collections and recommend strategies to alleviate risks while seeking a balance between access and collections use.

Restoration of a human skeleton

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A human skeleton was brought to our laboratory for examination and a treatment proposal. The age of the skeleton was of concern to the owner (a medical school) as it could not be replaced and represented the teaching history of the school. The skeleton had been set on a typical stand with wheels from the beginning of the last century. These are remarkably unstable and apparently the skeleton had suffered from falling over. Damage to the skeleton was extensive and the bones were brittle having been treated with several reagents to remove tissue and grease. The central problem was to restore the anatomical integrity of the bones that were damaged and strengthen weaken bones without compromising the original preparation evidence. New adhesives and fill material had to be chemically compatible with the original and be inconspicuous. We report on the use of various inserts to reinforce and join broken bones, also the nature of fillers used and consolidants to reinforce bone. Fillers were toned with pigments and coated with synthetic varnish (B-72 and PVA AYAA). It was necessary to find a new stand that would be more stable, yet easy to move.

Demands of modern research collection meet limits of historical setting: The construction of a new fluid collection facility in the frame of a 19th century building

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As many other museums, the Museum fuer Naturkunde Berlin (MfN) suffered from destruction during the World War II. Last ruins remained visible until recent years. Only in 1995, the planning for the reconstruction of the last destroyed part of the museum started. Ten years later the actual work begun, and in autumn last year the new collection facility was opened in a festive ceremony and handed over to its users and the public. What from the outside seems to be fully integrated in the original museums building will turn out to be a completely separated, modern collection facility behind the historical façade. It houses the fluid collections of the MfN, unifying one million specimens in 276,000 glass jars and 80 tons of alcohol formerly spread over all parts of the museum. The whole process of planning and building was a balancing act between the demands of the architecture and the requirements of an adequate collection management covering all aspects from preservation and environmental issues to access and usability.

The result is a fully air conditioned collection facility over three floors with 4630qm storage shelf

area and 12.6 km running board length, a separated storage facility in the basement for larger specimens, an automatic fire extinguishing system based on Nitrogen and fire resistant compartments, offices and laboratory areas nearby and an open collection with one part of the scientific collection (fishes, amphibians) open to the public.

Our presentation will give an inside view in this building project, and our experiences might help others when planning and implementing similar projects.

Digitizing Engelmann's Legacy: Providing Web Access to Plant Specimens Documenting the Great American Frontier

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Missouri Botanical Garden (MGB) Herbarium has endeavored to database and digitize more than 8,000 specimens representing plants collected by George Engelmann and his collaborators during pioneering expeditions into western North America following Lewis and Clark. These specimens represent the first scientific record of the plants growing in the vast wilderness west of the Mississippi River, and as such form the earliest verifiable documentation of species occurrences before the rapid migration west permanently altered that pristine landscape through human alterations and the introduction of invasive species. These specimens have been digitized and georeferenced in Tropicos (www.tropicos.org/project/engelmann), MBG's botanical information system, with visualization and analysis facilitated through integration of ArcGIS Server and other mapping applications. These specimens and the resulting interactive maps help inform scientists, students, and the public about the historic distributions of species throughout the native North American landscape.

Ethanol concentrations in preservative fluid: University of Kansas Biodiversity Institute Division of Herpetology fluid collections

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Ethanol concentrations were measured across the KUBI fluid collections in a planned, non-random, method. The Ethanol concentrations were measured with an accuracy of 0.1% v/v EtOH/water with an Anton Paar DMA 35n digital density meter. These values were used to test for a significant correlation between low Ethanol concentrations, (>70% EtOH), and lid type, gasket condition, container size, taxonomy, label type, shelf position, temperature, and container occupancy. 872 jars were tested out of an estimated 12,000 jars in the fluid collections. Testing the analysis of variance between groups (ANOVA) yielded significant correlations between low Ethanol concentrations and label type (a proxy for age) and high container occupancy (# of specimens in the jar). The other potential factors measured were shown to have no correlation to low Ethanol concentrations. This study shows that attention to potentially older jars and jars containing multiple specimens should be a priority when planning collection maintenance of alcohol-preserved specimens.

Global plant collector list

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For several years the Natural History Museum (NHM), has been involved in what is now known as the Global Plants Initiative, run under the auspices of JSTOR Plant Science. In addition to providing digitized versions of its type holdings, amongst other resources, the NHM has also worked to compile a list of plant collectors as a reference tool for the project.

Originally compiling a list of some 25,000 persons, recorded as plant collectors for Africa & Latin America, the Museum has now extended this to cover the whole globe. The dataset currently comprises almost 70,000 known collectors, both living and dead. In addition to providing basic data such as full name, birth and death dates where relevant, the dataset also includes information on plant groups collected, countries collected, herbaria holding material and known associates. Furthermore, for a sub-set of c. 5000 persons, full, detailed biographies have been compiled. Sources of information are also given although all relevant sources in the public domain have been scrutinized for potential new data. Work continues on the list,

available at http://plants.jstor.org/ both in terms of adding new collectors, and in compiling additional biographic material.

A 10-year review of the use of passive oxygen free environment enclosures for storage of oxygen sensitive specimens at the Natural History Museum

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For the last 10 years the Natural History Museum has been storing mainly earth science and botanical objects in oxygen free or reduced oxygen environments (ROE). The enclosures are generally made from a flexible barrier film and are designed to match the original footprint of an object. Passive ROE storage environments are, in relation to the value of the object, low cost and prevent the need for future treatment as they reduce rates of oxidative deterioration to a minimum. A review of the techniques, designs and an evaluation of the success rate of the enclosures are described. The future development and use of rigid, passive enclosures using new sealing technology and oxygen monitoring systems are also described along with a review of experimental use of these systems to control deterioration in natural organic materials.

Stringing two museums together: Integrating the Bead Society of Greater Washington's collection into the Yale Peabody Museum

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The Peabody Museum of Natural History recently accepted the entire deaccessioned collection of the now closed Bead Museum of Greater Washington DC. This is an impressive collection of necklaces, beads, pendants, purses, and a variety of strung objects made between 10,000 BCE and AD 2008. The collection arrived packed partially in a set of exhibit cases ("the timeline") and partly in cabinet drawers or boxes ("the general collection)." Integrating this collection into the Peabody's storage and cataloging systems has been challenging and instructive.

The Bead Museum's use of various numbering schema and cataloging procedures made the basic conversion of one database to another impossible. Integrating this heterogeneous collection into the Yale Peabody Museum database was further complicated because only a portion of the collection was cataloged and those objects were co-mingled with uncataloged materials.

Using a report generated from the original database, we inventoried the timeline exhibit to determine which items were cataloged. Unfortunately, only about 40% of the timeline was cataloged and therefore it was necessary to inventory the general collection to locate the remaining cataloged artifacts. Objects that were not in the database were added to the report using descriptions obtained from two sources provided by the Bead Museum: intake books (n=578) and the exhibit lectern guide (n=753).

In this presentation we describe our efforts to differentiate cataloged from uncataloged artifacts, import the existing database into the Peabody's system (EMu), describe the uncataloged objects, and rehouse the collection. After describing these processes we suggest an alternative strategy that would have made this process more efficient and future steps that will make the collection useful for the Peabody Museum's constituents.

The importance of extensive voucher specimen collections to basic invertebrate inventory, databases and Red Lists: case studies of 3 insect families (Carabidae, Culicidae and Formicidae) from the RBINS Entomology collection

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The main objectives of the Entomology Department of RBINS (Belgium, Brussels) are collection management, scientific research and public service. Management of the Scientific collections is the core activity of the Department. The collections compile more than 10.000.000 specimens of insects and arachnomorphs and these originate from the Palaearctic (Europe: mainly Belgium and neighboring countries); the Afrotropical region, the Oriental (mainly Southeast Asia, South China, Malaysia, Singapore, Indonesia, Cambodia and Thailand) and the Neotropics (Galápagos islands). Some of the collections are world renown as for instance Selys

Longchamps Odonata collection (873 primary types and ca. 45.000 specimens), Fain's Acari collection (115.000 slides and 1.500 primary types), the Staphylinidae collection of Fagel and Fauvel, the Cerambycidae collection of Lameere and the Elateridae collection of Candèze. So far most of the important and voluminous collections have been digitalized. For most insect groups the oldest specimens were collected before 1950 some even already in 1820. Some of these databases have been used to compile Documented Red data books that contain knowledge on insect distribution, protection of threatened habitats/species, documented lists with data on rarity, distribution, microhabitat and ecology of all Belgian species.

We here discuss the results and advantages of a revision of three RBINS subcollections (Carabidae, Culicidae and Formicidae) and the importance of extensive voucher specimen collections to basic invertebrate inventory, databases, Red Lists and health risk assessment studies.

An intra-institutional collaborative to develop a Biodiversity Information System (BiodIS)

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The Kansas State University Biodiversity Information System, BiodIS, is an ongoing collaborative among systematists and librarians within the institution. BiodIS has aggregated information associated with the institution's natural history collections and exposed it via a web portal to a broad audience of scientists, educators, and the general public. Available information includes specimen databases, images (both of specimens and field material) and digitized print resources. Educational materials stemming from projects associated with the collections are under active development. An overview of the BiodIS project is presented, along with discussion of advantages of cross-discipline partnerships to promote collections resources within an institution.

Corrosion and cleaning: What to do with ancient metals?

Fregni, G.

University of Sheffield

The internet is full of advice to amateurs about how to clean and care for coins and other metal artefacts. But how useful is the available information? Even in pre-internet days some forms of corrosion were exacerbated by poorly understood conservation techniques. The chemistry of non-ferrous corrosion is complex and not easily treated, and some treatments have the potential to do more harm than good.

At the request of a volunteer project at the Science Museum of Minnesota, a campaign of experiments using various techniques for cleaning and treating corrosion was undertaken using commonly found chemicals as described on popular websites. Prior to the experiment, all the bronze used exhibited forms of corrosion and tested positively for bronze disease. They were then subjected to treatment in order to see how the metal and the corrosion product would be affected and if there was any validity in the various treatments popularised on the internet. Results varied from pieces exhibiting no visible corrosion to individual examples being encased in a thick layer of corrosion.

Many websites purporting to offer 'tried and tested' advice often only mirror information from other sites without verifying the effectiveness of specific treatments. The proliferation of such unverified information can potentially cause well-meaning members of the public to inadvertently damage family heirlooms or pieces in private collections. Although conservators are frequently called upon for advice about caring for these objects they are often under-informed about the range of techniques and their effects recommended by internet sources. It is hoped that by knowing what information is available on the web, conservators can give more informed advice about caring for non-ferrous metals.

Labeling fossil vertebrates at the American Museum of Natural History: A wall chart

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Writing catalog numbers on specimens is a fundamental task of collection management. The catalog number is an essential link between the specimen and its associated data. If that link is broken - because the specimen number is missing, illegible or incorrect - the scientific value of the specimen is significantly diminished.

The Division of Paleontology, AMNH is currently updating and standardizing the materials and methods we use in labeling fossil vertebrates with a view to training various people in this task including staff, students and in particular interns and volunteers.

Through our combined experiences in collection management and fossil preparation we have learned from past labeling techniques that have failed or succeeded in our collections and have concentrated our efforts on making our methods simple, easy to teach and to follow. This is of particular importance when training teams of volunteers and interns to label large numbers of specimens.

As part of our training program we are compiling a handbook, website and wall chart to use both during and after training. These will serve to familiarize interns and volunteers with the archival materials in our labeling kit, the standards for writing legible numbers and letters and the importance of creating labels that are durable but removable if necessary.

This wall chart is a visual decision making guide. It summarizes the most common variables to consider when labeling fossil vertebrates, and indicates which materials and methods we recommend. It serves as a quick visual reference for consultation and assistance when labeling and reminds volunteers or interns to consult their supervisor for difficult decisions.

Integrating classical taxonomy and information technologies in bee systematics: The American species of Anthidium.

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Thanks to rapidly developing information and digital technologies new and powerful tools are now available to taxonomists. By integrating some of those technological tools to our on-going revision of the American species of wool carder bees (Megachilidae: *Anthidium* Fabricius), we show how such studies can be more meaningful to biologists and communicate effectively to non-specialists than classical approaches alone. About 80 of the nearly 200 species worldwide of *Anthidium* occur in the Americas, including two widespread adventive species from the Old World. In addition to the traditional taxonomic elements of keys, descriptions, illustrations and comparative statements, the following digital outputs are being produced: 1) specimen data captured and georeferenced in a relational database served through the Global Biodiversity Information Facility (GBIF); 2) fully illustrated species pages that include distribution maps, information on host plants and seasonality generated from the museum database; 3) an interactive digital identification guide that will assist conservation biologists, pollination providers and bee researchers to reliably identify these bees (http://www.discoverlife.org/).

Performance Indicators in Collections Management

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Since the 1980s, museums and other public-sector institutions, where performance cannot be measured simply by profit, have developed performance indicators (PIs) for use by museum managers, funding bodies and regulators to demonstrate accountability, efficiency and effectiveness. Collections management PIs are often

used in this context, rather than to inform policy and planning in collections management, for which these traditional measures are often of limited value. This poster presents a list of suggested PIs for use in collections management, which could be used to assist the formation of policy and to improve standards of service, efficient use of resources, control of decision making and to develop more efficient ways of working in collections management. They cover six areas: collections, access and use of collections, digitisation, collections management and conservation, research and scientific activities and resources. The rules and units of measure are carefully defined, to ensure that indicators from different departments or institutions are comparable.

Implementation of Geographic Information Software (GIS): Usefulness as a collection management tool to aid academic research and public access

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Amgueddfa Cymru / National Museum Wales (AC / NMW) has high standards of natural history custodianship, and well developed and tested collection management policies and procedures. The Department of Geology holds over 65,000 mineral and rock, and 200,000 palaeontological specimens which are fully catalogued with electronic database records. The database was designed as a collection management tool for accountability, but at present does not allow direct public access to data without museum staff retrieving information on their behalf.

We are now developing a new phase of information use and access. By changing the way information relating to the collection can be accessed, I hope to increase and encourage further use of the collections. GIS has been successfully piloted by another department at AC / NMW as a tool to aid staff research, but is not fully implemented in the Department of Geology.

The way staff and public seek collection-related information can be greatly enhanced with GIS. It will allow collection information to be compared spatially, where previously this was not possible. Geological data lends itself very well to spatial display. The department aims to improve accessibility to its collections by making data available on GIS *via* a web-based public interface. This will allow users to research their own enquiries, and has the added benefit of saving valuable staff time.

We anticipate that allowing the public to 'make connections' with collections from a particular area to which they relate, or which have special meaning for them will be extremely beneficial. Access to the website will be monitored and patterns of use evaluated once GIS has been fully implemented.

I would welcome any information relating to other geological collection data based on GIS.

GIS database development for collections space management and planning in the Smithsonian Institution NMNH Department of Paleobiology

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Smithsonian Institution National Museum of Natural History, PO Box 37012, MRC 121, Washington, DC 20013-7012

The Department of Paleobiology at the National Museum of Natural History holds the U.S. National Collection of Fossils, one of the largest and most diverse collections of fossils in the world. The collection's size, breadth, and age combined with limited staff and resources have resulted in variation in the manner and quality of physical specimen storage and documentation. Most of the collections are not digitized in NMNH's collection database, EMu. Therefore, estimating the number and volume of specimens for planning and management is a considerable challenge. The Department is faced with several large-scale renovation projects in the next ten years. For each renovation, the Department must provide accurate estimates of temporary storage needs and post-renovation space requirements. Additionally, the Department must plan for how to improve storage equipment and configuration. To facilitate efficient collections planning and management, we are developing a GIS database to visualize collection data. ArcGIS will allow us to visually determine the location and scope of predetermined collections priorities and available space. Each layer's attribute table will contain fields that capture collection health and space data. We anticipate mapping the EMu locations data (e.g. floor, row, case, and drawer) to layers within the GIS database so every record in EMu with related locations data can be visualized in ArcGIS. Ultimately, the GIS database will be completely migrated to EMu and be used through the EMu Object Locator mapping utility. This utility is in the early stages of

planning and development in the NMNH Informatics department. The ArcGIS database will be essential for planning the functionality of the EMu Object Locator utility.

Making friends through integrated pest management

Jones, L.
Yale Peabody Museum of Natural History, PO Box 27384, West Haven, CT 06516-0972

Integrated pest management policies and procedures have largely been designed from a single museum perspective. Here we look at the process of collaborating with four different museums sharing a single building for collections storage. The Yale Peabody Museum of Natural History has an active integrated pest management program that was expanded to the retrofitted West Campus Collections Research Facility. Collections from the Yale University Art Gallery, Yale Center for British Art, and Collection of Musical Instruments are in the process of moving to the same facility, creating the potential for inter-museum pest infestations. We explore the collaboration efforts of sharing staff, sharing equipment, unifying policies, and designing future resources between these unique museums. A cooperative integrated pest management program objective will include ownership of responsibility for activities within the building and lead to a pest-free collections storage facility.

AIM-UP! A research coordinating network to increase the use of museum collections in undergraduate education

Lacey, E.A.[1], Cicero, C.C.[1], Cook, J.A.[2], Ickert-Bond, S.[3], Edwards, S.V.[4]
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Natural history collections provide invaluable resources for numerous aspects of undergraduate education, including instruction in evolution, biodiversity, and conservation. The value of these resources as educational tools, however, is often poorly understood, even at colleges and universities that maintain such collections. AIM-UP! is an NSF-funded Research Coordinating Network (RCN) developed to increase awareness of natural history collections as critical resources for undergraduate instruction. Specific goals of the network include (1) training undergraduates in museum-based research, (2) developing instructional tools based on freely-accessible online museum databases, (3) informing educators at non-museum institutions regarding the instructional power of museum collections, and (4) interacting with the public to increase awareness of the educational importance of natural history museums. Each year of the initial 5-year project will emphasize a different conceptual theme: during our first year, the network has focused on developing integrated strategies for collecting and analyzing data from multiple taxonomic groups, each of which has distinct research and curatorial traditions. Starting with a seminar on this theme held at UNM (and attended electronically by network participants from other institutions), the network has developed an initial set of educational modules that draw upon the publicly-accessible ARCTOS database to provide students with hypothesis-driven, inquiry-based learning opportunities rooted in natural history collections data. Educators from all institutions – those with museums and those without – are encouraged to visit our website (www.aim-up.org) and to consider participating in the network.

Discovering '*Discovery*': Developing a historical collection sustainability

Lowe, M.C.
The Natural History Museum, Cromwell Road, London SW7 5BD

The *Discovery* collection consists of samples and species collected during the *Discovery* expeditions (1925 – late 1990's). These expeditions were a series of scientific cruises that studied the southern ocean. They looked at the chemistry of the ocean, its ecology and hydrology. The bulk of the collection was donated to The Natural History Museum, London by the Institute of Oceanographic Sciences in the 1990's. It represents 70 years of planktonic and benthic collecting, which is never likely to be repeated. These collections may contain species that are extinct in the world's oceans today. There are over 20,000 jars of Crustacea specimens,

including crabs, krill and shrimps preserved in fluid and 27,000 jars of plankton samples which are the focus of this study. Making this collection relevant to current research practices, accessible and sustainable for the future provides a curatorial challenge due to inherited problems. Previous history has shown that over time the collections passed through various institutions, some became separated, data held within has become unstructured and specimen containers were not suitable long term storage. Partnerships with the Museum and other organisations such as the National Oceanographic Centre, Southampton and the British Antarctic Survey are one such solution to these problems and provide opportunities for collections research and potential funding for continued curatorial practices so that both specimens and data have longevity.

After the storm: Survival strategies for a multifaceted curation project

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Successful funding is just the precursor to a stretch of highly focused and intense work. Projects begin with a coordinated plan of action; a chart to the critical final goal. Despite built-in contingency plans there can be unforeseen dynamics that disrupt the initial scheme. Although the ideal project has few such issues, tasks do not take place in a vacuum; there is a constant process of learning, discovery and cross-fertilization of ideas. These processes may improve or disturb work on the current project or be the basis for future endeavors. The critical question to resolve is which issues should be addressed now and which to set aside for later.

Texas Natural Science Center completed a project, funded by the National Science Foundation through their Biological Research Collections program (DBI 0646468), to conserve and digitize the type and figured collection of the Non-vertebrate Paleontology Laboratory. It involved a facilities redesign, transport of specimens, conservation and imaging of specimens, and related materials, and provision for research and public access to the data. This multifaceted mission could easily drift off course. As one individual task often relied upon successful completion of another any major diversion from the original plan could disrupt the entire venture.

Critical issues emerged during the course of this project. Those tackled were associated with imaging, specifically unplugging data processing bottlenecks and creation of more informative imagery. Non-traditional strategies, including discrete event modeling, were imported and new techniques or protocols inserted into the original plan to address the problematic aspects.

Enhancing the Bear Gulch Paleontological Research Collection at the University of Montana

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Accessibility and digitalization have become top priorities for many museum collections. There are numerous different data base programs available; however, most of these programs are not available on the internet. With this in mind The University of Montana Paleontology Center (UMPC) had an interactive data base developed that is accessible to anyone with an internet connection. This innovative data base is composed of various features that may not be available in other programs. This NSF-BRC supported project (200982011) focused on the Carboniferous Bear Gulch Limestone (BGL) fauna of Montana, that contains a wealth of vertebrate, invertebrate, and plant fossils preserved on flat limestone slabs.. Specimens were either scanned or photographed, and then images were uploaded to the specimen page. During digitization, students double checked the BGL specimen information, including taxon, locality, and other data. The UMPC collections were further enhanced by the installment of a space saving compactor system and new storage cases. This compactor system increased available storage capacity by 40%, thus decreasing the amount of physical space needed for storage. While the renovation was taking place, a large scale inventory and re-organization of the BGL collection was completed. These enhancements of the collection greatly improved the ability of the UMPC to support specimen-based research.

Each one better than the last: The evolution of a storage mount

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At the Science Museum of Minnesota, ceramic objects are stored on compacted open shelves. Since the shelves must be moved to access objects, the ceramics must be supported by high quality storage mounts.

Tall, thin vessels and standing ceramic figurines present a challenge in this mobile environment. A two-part contoured mount for ceramic vases was first developed during SMM's collections move in 1999. The original mount, published in Moving the Mountain: Science Museum of Minnesota Guide to Moving Collections, supports the artifact with contoured polyethylene foam braces on two separate boards. The boards slide together and secure the artifact.

Subsequent mount makers have improved on this original design, making it more user-friendly. Recent acquisitions of contemporary Mexican ceramic figurines encouraged further mount improvements. The curator requested that the figurines be stored in standing positions for best visibility. In order to reduce the use of polyethylene foam and to use up small scraps of acid free corrugated cardboard, the mount was constructed primarily from the cardboard, with small carved foam pads to support the object. The mount is more "green" than previous incarnations and provides excellent support and visibility.

Three-Phase Comprehensive Collections Inventory at the University of Iowa Museum of Natural History

Opitz, C.
Museum of Natural History, The University of Iowa, 11 Macbride Hall, Iowa City IA 52242.

The University of Iowa Museum of Natural History was founded over 150 years ago, to serve as a state repository for specimens collected during early surveys of the then newly created state's natural resources, and to serve academic scientific studies at the University of Iowa. Since then, collections originated from University expeditions, faculty collection/research, direct Museum acquisition, and private donations. UIMNH collections have the potential to serve in international research in a greater capacity, once collections are fully accounted for and made searchable on line.

A comprehensive, three-phase inventory project was begun to discover and document everything UIMNH holds (Phase I, location-based inventory), connect existing records with collection objects and update collection records for the electronic age (Phase II, records-based inventory), and assess/improve the condition of objects and storage conditions in UIMNH collections (Phase III).

During Phase I, every box and drawer was opened, photographed, and the contents documented. The final count was over 115,000 objects, though only 40,000 are cataloged. Many drawers were packed full—nests, eggs, and much of the marine invertebrate collections were re-housed in standardized, stackable archival boxes, to stabilize them and facilitate the inventory process. Phase II began with a host of students typing the 150-year-old catalog into a searchable electronic format, then shifted to reconciling Phase I data with the catalog and collection databases (still underway), cataloging/creating new database records for specimens as necessary, and preparing data for linking with established specimen research portals. Phase III will include a detailed assessment of collections conditions, visits from specialists to assess the collections' scientific value, identification of potential funding sources, and improvements to storage conditions.

Water damaged herbarium specimens: Overview of the procedure at Harvard University Herbaria

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Working in a natural history collection requires knowledge of many facets of preservation, but staff members also need to be responsive to emergencies. During the holiday break of December 2008, a pipe burst after recent renovations in one of the Harvard University's Herbaria compactor rooms, resulting in an immediate 'flood.' A few senior staff members were available to remove the wet specimens from the cases, quickly assess the degree of wetness, put saturated specimens, still in genus folders, in plastic bags and immediately place them in a large walk-in freezer set at -20ºC. Slightly wet

sheets were spread out on dry surfaces to air-dry. The next phase of recovery of the frozen specimens involved determining the best method to restore them to usable condition. To evaluate procedures for drying the specimens a company specializing in document restoration was contracted to carry out drying tests. Using intentionally soaked herbarium specimens of no scientific value, two separate experiments were performed; 1) using silica gel as a desiccant, and 2) vacuum freeze-drying. Based on the results, vacuum freeze-drying was chosen as the preferred method because the specimens did not adhere as much as those dried using silica gel. The quality of the dried specimens using both methods was surprisingly good. Except for slight bleeding of water soluble inks on the sheets and labels, and from some of the folders, the specimens were in remarkably good condition and perfectly adequate for scientific analysis. The final phase of the recovery will be to examine the actual specimens once freeze-drying is completed, repair damaged specimens, then place them back in the collection for the use of researchers.

A new and long awaited central quarantine facility at the NHM, London

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The Natural History Museum. Cromwell Road, South Kensington, London, SW7 5BD, UK

The Natural History Museum, London has a successful and comprehensive IPM program in place with a clear policy, strategy and 5 year implementation plan which is agreed and reviewed at director level. We have an IPM group made up of staff members from every department which is committed to protecting the collections at all NHM sites, South Kensington, Wandsworth, Tring and where possible off site, on loan by implementation of a relevant strategy and policy in line with the Museums mission and vision.

The principles behind Integrated Pest Management are to eliminate or at least limit any possible chance of entry or contamination by a process of:

- quarantine
- monitoring
- housekeeping
- facilities design and maintenance
- storage
- environmental control
- best work practice

The aim of the IPM policy and strategy is to protect the collections against pest attack using all of these essential elements and this can only be achieved by a holistic approach involving everyone in the Museum contributing to its success.

One of the areas that the group has been working relentlessly on for many years is the provision of a central quarantine facility. This facility is fundamental to the continued success of the IPM program at the NHM with is multi-functional operations and collection of buildings ranging from the new purpose built collection facility of Darwin Centre to the old terracotta grade I listed building that makes up a large part of the Museum.

Resources where obviously a big issue when planning for this facility but in the centre of London probably our biggest obstacle once we secured support for the facility was finding the physical space.

Yale digital core to promote the collaborative curation of cultural heritage materials

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Yale University's West Campus presents an opportunity to enhance teaching, research and dissemination in the digital age through a cross-domain collaboration. The Office of Digital Assets and Infrastructure (ODAI) is charged with developing Yale's digital content and infrastructure that ensures Yale's digital assets will be discoverable and accessible for teaching and research as well as provide a platform for disseminating the University's intellectual digital assets. ODAI has entered into a partnership with the Yale University Art Gallery, Yale Center for British Arts, Yale University Library-Beinecke and Yale Peabody Museum to develop a state-of-the-art digitization facility on Yale's West Campus that will be a collaborative curation of museum, library and archival materials. This Digital Core is an opportunity to focus on creation, dissemination and preservation of Yale's diverse collections and acknowledge their commonalities.

The unique environment of the Digital Core will allow for the development of a community of cross-domain expert staff, enabling shared investments thus spreading costs across multiple units. Shared production activities will allow cross-collection integration and give staff working in libraries, archives and museums a more complete hands-on approach to understanding collections and

processes with which they are not familiar. This centralized Digital Core, with its best practices and standards related to digital capture, metadata and file formats for teaching and research collections, will lead the way to greater innovation.

VertNet: Distributed databases with backbone

Spencer, C.[1], Koo, M.[1], Bloom, D.[1], Cicero, C.[1], Wieczorek, J.[1], Guralnick, R.[2], Peterson, T.[3], Russell, L.[3], Vieglais, D.[3], Rios, N.[4], Bart, H.[4]
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Alarm over global climate change and associated loss of biodiversity has resulted in international demand for quick, reliable access to high quality data on the spatio-temporal occurrence of species and their relation to environment. Responses to this demand have led to the development of four NSF-funded distributed database vertebrate networks (FishNet2, MaNIS, HerpNET, ORNIS), which currently include 171 collections from 12 countries and 52 additional collections (20 countries) committed to participation. Collectively, these networks have successfully demonstrated community data sharing and cooperative data management. Participation in each of these networks has far exceeded expectations, resulting in growing problems of scalability, performance, sustainability, and ability to incorporate new members. The proposed creation of VertNet will address these problems by using a cloud-based computing strategy to create a fast, cost-effective, and scalable data platform. This new platform will have capabilities and applications for data discovery, data quality improvement, and visualization that go beyond those of the current networks. Specifically, VertNet will (1) have new user interfaces with expanded search capabilities, (2) incorporate new kinds of data, (3) provide improved, open methods for accessing data, (4) enable customized change notifications, and (5) create novel annotation and user feedback services. This strategic combination of open access to data, new capabilities, and integration with other applications will transform the use of vertebrate biodiversity data for cross-disciplinary research and for conservation.

GBIF-Sweden 2005-2010: An up-date on Swedish biodiversity collection and observation informatics

Telenius, A.
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The objective of GBIF (Global Biodiversity Information Facility) is to provide free and universal access to the world´s biodiversity data. Almost 270 million objects and observations worldwide of plants, animals and fungi are covered by http://data.gbif.org, and only in Sweden 27 million data are presented telling about what, where, and when, and by whom an item was collected (some over 250 years old) or an observation made (www.gbif.se). Starting in 2005 at nil, we are now able to present almost 80 % of the digitized objects present in Swedish natural science collections (where, however, yet another 80% of all items contained await digitization!). In addition to this, old and new observations continue to add to the database, and altogether almost half of all collected and observed primary biodiversity data can be scanned by anyone fitted with a computer and Internet access. Using relevant analytic tools, such information may be valuable to researchers in order to assess the past and present state of species, to model and predict change in relation to varying ambient conditions, and to analyze phylogenetic relationships. Public planning at local to global level is aided given that the whereabouts of species are known, and for educational purpose the availability of this kind of information is crucial in fostering environmental awareness.

Field Note Digitization at Rancho La Brea: A Preliminary Case Study

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[2]George C. Page Museum at the La Brea Tar Pits, 5801 Wilshire Blvd, Los Angeles, CA 90034
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In many active paleontological excavations, field notes are the primary record of fossils' taxonomic identification, provenance and very

existence. However, field data are rarely stored digitally. This creates major problems for collection managers. Without easily accessible field data, there is no way to quickly and accurately assess holdings until fossils are prepared and catalogued. Here we discuss one solution to this problem: a digitized "pre-catalogue" for the multitude of fossils not yet formally identified. Such a pre-catalogue requires digitizing field data, migrating them to a consistent format, and then parsing for elements such as taxon name, element, and original location.

Here we present a case study for creation of a pre-catalogue utilizing field notes at the George C. Page Museum at the La Brea Tar Pits. Excavation of Pleistocene deposits at Rancho La Brea (RLB) has been almost continuous since 1969, and has created a large backlog of formal cataloguing. Data about uncatalogued fossils are dispersed among thousands of pages of field notes, and stored in multiple formats and locations. Manual searches for collections data are thus extremely time consuming and cause additional wear and tear on these essential documents.

The process for creating the RLB pre-catalog is: 1) Handwritten field notes will be transcribed, and typewritten notes converted to text files using optical character recognition software; 2) A simple Java program will parse these files for taxonomic and locational data, and generate a spreadsheet containing these data; 3) The spreadsheets will be integrated into a pre-catalogue database.

Environmental Management System at the Natural History Museum, London, UK.

Tomsett, L.
The Natural History Museum, Cromwell Road, London, SW7 5BD, UK.

The Environmental Management System (EMS) at the Natural History Museum (NHM) has a holistic approach to sustainability and entails compliance with environmental legislation, documented management systems, controls and training/awareness, regular internal audits and bi-annual external audits conducted by British Standards. The EMS has seven objectives covering the areas of sustainability of the entire organisation, communications, waste, purchasing, water, travel and overall carbon footprint.

The NHM has been actively involved in energy conservation since 1989 and has made significant achievements including the introduction of engineering solutions such as the Building Management System (BMS), Carbon Reduction Commitment (CRC) and European Union Emissions Trading Scheme (EUETS).

In 2001, a cross-departmental Environmental Focus Group (EFG) was set up to examine the legislation relating to current practices and determine the most significant risks to the Museum. This has become an integral component of the EMS and includes representatives from all areas of Museum operations.

In April 2003, the NHM became the first Museum in the UK to achieve ISO14001 standard when it announced that its EMS had achieved certification to the stringent standards of BS EN ISO 14001:1996. This has since been upgraded to ISO14001:2004. The accreditation covers all three of the Museum's sites.

These successes underline the Museum's on-going commitment to a comprehensive policy that seeks to minimise the environmental impact of all aspects of the Museum's business.

Diatoms on the move: The story of a collections development project

Wilbraham, J., Yesilyurt, J.C.
Natural History Museum, Cromwell Road, London, SW7 5BD.

The NHM diatom collection includes some 200,000 slides, bottles, herbarium sheets and boxed fossil deposits collected worldwide from the early 19th century to the present day. The diatom collection was housed in a separate area to the rest of the botany department. As the collections had grown into this space over many years there were problems with accessibility and development was hindered. In early 2010, it was an ideal time to move the diatom collections as due to other re-development projects across the department, we now had space to unite these into one cryptogamic collections area. We were also able to make use of resources left behind from the flowering plant move to the new DC2 building which had just completed. We planned to use the opportunity provided by the move to raise standards of collections care for the diatoms and improve documentation of the collections which we could then make available online. The move of the collections was largely undertaken by NHM staff and a transient project

team was set up to deliver this. This poster gives an overview of the project, some of the problems and the benefits achieved.

Nature in the classroom: Bringing museum specimens into public schools

Wimberger, P., Shugart, G., True, K.
Slater Museum of Natural History, University of Puget Sound, Tacoma, WA

Few teachers have the resources, knowledge or time to teach K-12 students natural history. Working with teachers and administrators we put together a set of curricula designed to hone elementary students' observational skills and address state science learning requirements. The curricula were designed to bring natural history into classrooms and provide students with museum specimens they could handle. We think of the three kits as "Field Trip in a Box." The first project asks students to carefully observe various natural history artifacts that they might find in the region. The second project asks students to draw, think and write about structures and functions in 30 local bird species. In the final project, students key out skulls of local mammals and make inferences about their diets. We will share lessons learned from our first year of implementation, as well as provide examples of specimens with instructions for making hearty teaching skins that can withstand a lot of love from upper elementary students.

Being sustainable! The challenge for the collections manager of the future.

Yesilyurt, J. C.
Natural History Museum, Botany Department, London, SW7 5BD, UK.

It is becoming obvious that sustainability does not solely relate to science (i.e. environmental issues). Every individual, institution, and entrepreneurial sector is facing this challenge. A "sustainable museum and sustainable collections" can perhaps conceptually be divided into 3 aspects: Environment, Finance and Usability.

What is being sustainable? It is about change. It is about managing for the long term as well as the short term. Being sustainable should mean being not only financially and resource efficient but also effective (and non-static) in delivering information to present and future users. The risk in broadening the concept of sustainability can be seen every day. Who needs books now? People "sustainably" recycle their books to charity shops or dump them in the paper recycling bin! Libraries are becoming increasingly 'digital'. But what about collections? Do they face the same fate? There is a feeling that the digital revolution will mean that in the future there won't be so much need for the collections (and the people who work on them). The question may be: how can we be sustainable (both individually and collectively) in this rapidly changing time? The common view is that the virtual herbarium will make collections sustainable in many ways. For example, it allows people to access collections without expending fuel on trains, cars and planes. However, the collections are not static books! A sustainable collection is one that changes. Feedback between the unpredictable and perhaps vulnerable virtual world and the physical collection is essential to sustain a collection! What tools, skills and underlying philosophy will the collections manger of the future need to face the challenge?

Poster List

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2	Bohning & Campbell	Ethanol concentrations in preservative fluid: Univ. of Kansas Biodiversity Institute Division of Herpetology fluid collections
3	Allington-Jones, Bernucci, Collins, Cornish & Verveniotou	Trouble in the Gallery: Balancing displays needs with conservation requirements to provide a sustainable solution to building based environmental problems at the Natural History Museum, London
4	Collins & Allington-Jones	A 10-year review of the use of passive oxygen free environment enclosures for storage of oxygen sensitive specimens at the Natural History Museum
5	Tomsett	Environmental management system at the Natural History Museum, London, UK
6	Dekoninck, Hendrick, & Grootaert	The importance of extensive voucher specimen collections to basic invertebrate inventory, databases and Red Lists: case studies of 3 insect families (Carabidae, Culicidae & Formicidae) from the RBINS Entomology collection
7	Gonzalez, Huntzinger, Droege, & Griswold	Integrating classical taxonomy and information technologies in bee systematics: the American species of Anthidium
8	Ferguson, Mayfield, Allen, Haddock, Maringanti, Oleen, & Zolnerowich	An intra-institutional collaborative to develop a Biodiversity Information System (BiodIS)
9	Adrain, Maltas & Randall	The value of ancillary collections: A justification for their preservation, organization and digitization
10	Anderson	What's ahead: using a general survey as a planning tool
11	Fregni, G	Corrosion and cleaning: what to do with ancient metals?
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13	Gregson	Performance indicators in collections management
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Ariño, A.H.	Ariño	Oral
Ayres, R.	Ayres & Eklund	Oral
Baillargeon, G.	Desmet, Brouillet, Baillargeon, Macklin, Hyde, & Bruneau	Plenary
Barber, A.C.	Barber, Lafferty & Landrum	DemoCamp
Bardolph, P.	Bardolph	Oral
Barker, J.P.	Malloy, Hattori & Barker	Oral
Bart, H.L., Jr.	Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart Rios & Bart	Poster DemoCamp
Bartsch, P.	Bartsch & Quaisser	poster
Beccaloni, J.	Beccaloni	oral
Beidleman, R.G.	Doran, Kasameyer, & Beidleman	oral
Bentley, A.	Bentley, Granzow-de la Cerda, & Specify Software Project staff	DemoCamp
Bernucci, A.	Allington-Jones, Bernucci, Collins, Cornish & Verveniotou	poster
Best, J.	Best, Neill & Moen	DemoCamp
Bisang, I.	Huxley, Maldar & Bisang	Oral
Blomberg, M.	Blomberg, Freeland, Holland, Keil, Paige, Stimmel	poster
Bloom, D.	Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart	poster
Bohning, T.	Bohning & Campbell	poster
Broad, G.	McAlister & Broad	Oral
Brouillet, L.	Desmet, Brouillet, Baillargeon, Macklin, Hyde, Bruneau	Plenary
Bruneau, A.	Desmet, Brouillet, Baillargeon, Macklin, Hyde, Bruneau	Plenary
Bryant, J.M.	Bryant & Russell Russell & Bryant	Oral Oral
Buffington, M.	Buffington & Gates	oral
Cafferty, S.	Cafferty & Lewis	poster
Caldararo, N.	Antonetti, Hirschbein, & Caldararo	poster
Campbell, A.C.	Bohning & Campbell	poster
Carter, J.	Carter	Oral
Catling, P.	Mitrow & Catling	oral
Chamberlain, A.	Molineux, Zachos, Criswell, Heron, Womack, & Chamberlain	poster
Chef Holmberg, I	Chef Holmberg	oral

Cicero, C.	Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart Koo, Spencer, Cicero, Jarrell & McDonald Jordan, Jarrell, Ickert-Bond, McDonald, Cicero & Koo Lacey, Cicero, Cook, Ickert-Bond & Edwards	Poster DemoCamp Oral poster
Cifelli, R.	Starly, Raman, Cifelli & Davies	Oral
Collins, C.	Allington-Jones, Bernucci, Collins, Cornish & Verveniotou Collins & Allington-Jones Collins	poster poster oral
Colten, R.	DeAngelo, DaRos & Colten	poster
Cook, J.A.	Lacey, Cicero, Cook, Ickert-Bond & Edwards	poster
Cornish, L.	Allington-Jones, Bernucci, Collins, Cornish & Verveniotou	poster
Crimm, W.	Crimm & Goulette	Oral
Criswell, K.	Molineux, Zachos, Criswell, Heron, Womack, & Chamberlain	poster
DaRos, M.	DeAngelo, DaRos & Colten	poster
Davidson, A.R.	Gishlick, O'Leary, & Davidson	poster
Davies, K.	Starly, Raman, Cifelli & Davies	Oral
DeAngelo, R.	DeAngelo, DaRos & Colten	poster
Dekoninck, W.	Dekoninck, Hendrickx, & Grootaert	poster
Desmet, P.	Desmet, Brouillet, Baillargeon, Macklin, Hyde, Bruneau	Plenary
Doran, A.S.	Doran, Kasameyer, & Beidleman Hoffman & Doran	Oral oral
Dou, L.	Dou, Hanken, Ludaescher, Macklin, McPhillips, P. Morris, R. Morris & Wang	DemoCamp
Droege, S.	Gonzalez, Huntzinger, Droege & Griswold Huntzinger, Droege & Griswold	poster Oral
Eastwood, R.	Morris, Eastwood, Haley & Ford	DemoCamp
Edwards, S.V.	Lacey, Cicero, Cook, Ickert-Bond & Edwards	poster
Eklund, L.	Ayres & Eklund	Oral
Farrell, A.	Thomer, Farrell, & McCune	Poster
Ferguson, C.J.	Ferguson, Mayfield, Allen, Haddock, Maringanti, Oleen & Zolnerowich	Poster
Florence, M.S.	Hollis & Florence	poster
Ford, L.S.	Morris, Eastwood, Haley & Ford	DemoCamp
Freeland, C.	Blomberg, Freeland, Holland, Keil, Paige, Stimmel	poster
Freeman, E.	Freeman & Harris	Oral
Fregni, G.	Fregni	poster
Gates, M.	Buffington & Gates	oral
Gishlick, A.K.	Gishlick, O'Leary, & Davidson	poster
Gonzalez, V.H.	Gonzalez, Huntzinger, Droege & Griswold	poster
Goulette, K.	Crimm & Goulette	oral
Granzow-de la Cerda	Bentley, Granzow-de la Cerda, & Specify Software Project staff	DemoCamp
Gregson, J.	Gregson	poster
Griswold, T.L.	Gonzalez, Huntzinger, Droege & Griswold Huntzinger, Droege & Griswold	poster oral
Grootaert, P.	Dekoninck, Hendrickx, & Grootaert	poster
Guralnick, R.	Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart	poster
Haddock, M.J.	Ferguson, Mayfield, Allen, Haddock, Maringanti, Oleen & Zolnerowich	Poster

Haeuser, C.L.	Quaisser & Haeuser	oral
Haley, B.	Morris, Eastwood, Haley & Ford	DemoCamp
Hanken, J.	Dou, Hanken, Ludaescher, Macklin, McPhillips, P. Morris, R. Morris & Wang	DemoCamp
Harbottle, N.	Snow, Harbottle, James, Ranker, Thomas & Lorence	Oral
Harding, D.G.	Harding	Oral
Harris, L.	Freeman & Harris	Oral
Hatton, J.	Hatton	Oral
Hattori, E.M.	Malloy, Hattori & Barker	Oral
Haycock, A.	Haycock	poster
Hendrickx, F.	Dekoninck, Hendrickx, & Grootaert	poster
Henry, D.A.	Henry	oral
Heron, C.	Molineux, Zachos, Criswell, Heron, Womack, & Chamberlain	poster
Hirschbein, J.	Antonetti, Hirschbein, & Caldararo	poster
Hoffman, C.R.	Hoffman & Doran	Oral
Holland, D.	Blomberg, Freeland, Holland, Keil, Paige, Stimmel	poster
Hollis, K.A.	Hollis & Florence	poster
Huntzinger, K.T.	Gonzalez, Huntzinger, Droege & Griswold Huntzinger, Droege & Griswold	poster Oral
Huxley, R.	Huxley Huxley, Maldar & Bisang Huxley & Maldar Maldar & Huxley	Plenary Oral Oral oral
Hyde, D.	Desmet, Brouillet, Baillargeon, Macklin, Hyde, Bruneau	Plenary
Ickert-Bond, S.	Jordan, Jarrell, Ickert-Bond, McDonald, Cicero & Koo Lacey, Cicero, Cook, Ickert-Bond & Edwards	Oral poster
Iverson, A.	Newberry & Iverson	poster
James, S.A.	Snow, Harbottle, James, Ranker, Thomas & Lorence	Oral
Jarrell, G.	Jordan, Jarrell, Ickert-Bond, McDonald, Cicero & Koo Koo, Spencer, Cicero, Jarrell & McDonald	Oral DemoCamp
Jones, L.	Jones White, Jones, & Van Aken	Poster Oral
Jordan, C.	Jordan, Jarrell, Ickert-Bond, McDonald, Cicero & Koo	Oral
Kageyama, M.	Kageyama	Oral
Kasameyer, A.F.	Doran, Kasameyer, & Beidleman	oral
Keil, S.	Blomberg, Freeland, Holland, Keil, Paige, Stimmel	poster
Koo, M.	Koo, Spencer, Cicero, Jarrell & McDonald Jordan, Jarrell, Ickert-Bond, McDonald, Cicero & Koo Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart	DemoCamp Oral poster
Lacey, E.A.	Lacey, Cicero, Cook, Ickert-Bond & Edwards	poster
Lafferty, D.	Barber, Lafferty & Landrum	DemoCamp
Landrum, L.R.	Barber, Lafferty & Landrum	DemoCamp
Lewis, C.	Cafferty & Lewis	poster
Lorence, D.H.	Snow, Harbottle, James, Ranker, Thomas & Lorence	oral
Lowe, M.C.	Lowe	Poster
Ludaescher, B.	Dou, Hanken, Ludaescher, Macklin, McPhillips, P. Morris, R. Morris & Wang	DemoCamp

Lum, M.	Mudge, Schroer, Lum Mudge, Schroer, Lum	Oral DemoCamp
Macklin, J.A.	Desmet, Brouillet, Baillargeon, Macklin, Hyde, Bruneau Dou, Hanken, Ludaescher, Macklin, McPhillips, P. Morris, R. Morris & Wang	Plenary DemoCamp
Maldar, G.J.	Huxley, Maldar & Bisang Huxley & Maldar Maldar & Huxley	Oral Oral oral
Malloy, R.K.	Malloy, Hattori & Barker	Oral
Maltas, B.N.	Adrain, Maltas, & Randall	poster
Maringanti, H.	Ferguson, Mayfield, Allen, Haddock, Maringanti, Oleen & Zolnerowich	Poster
Martin, G.	Martin	Oral
Mayer, P.S.	Mayer	Oral
Mayfield, M.H.	Ferguson, Mayfield, Allen, Haddock, Maringanti, Oleen & Zolnerowich	Poster
McAlister, E.	McAlister & Broad	Oral
McCune, T.	Thomer, Farrell, & McCune	Poster
McDonald, D.	Jordan, Jarrell, Ickert-Bond, McDonald, Cicero & Koo Koo, Spencer, Cicero, Jarrell & McDonald	Oral DemoCamp
McPhillips, T.M.	Dou, Hanken, Ludaescher, Macklin, McPhillips, P. Morris, R. Morris & Wang	DemoCamp
Mendez, A.	Ryder & Mendez	Poster
Mitrow, G.	Mitrow & Catling	Oral
Moen, W.E.	Best, Neill & Moen	DemoCamp
Molineux, A.	Molineux, Zachos, Criswell, Heron, Womack, & Chamberlain	poster
Moore, K.L	Moore & Stanley	poster
Morris, P.J.	Dou, Hanken, Ludaescher, Macklin, McPhillips, P. Morris, R. Morris & Wang Morris, Eastwood, Haley & Ford	DemoCamp DemoCamp
Morris, R.A.	Dou, Hanken, Ludaescher, Macklin, McPhillips, P. Morris, R. Morris & Wang	DemoCamp
Mudge, M.	Mudge, Schroer, Lum Mudge, Schroer, Lum	Oral DemoCamp
Neill, A.K.	Best, Neill & Moen	DemoCamp
Neuhaus, B.	Schuda & Neuhaus	oral
Newberry, R.	Newberry & Iverson	poster
O'Leary, R.	Gishlick, O'Leary, & Davidson	poster
Oleen, J.K.	Ferguson, Mayfield, Allen, Haddock, Maringanti, Oleen & Zolnerowich	Poster
Opitz, C.	Opitz	poster
Paige, J.	Blomberg, Freeland, Holland, Keil, Paige, Stimmel	poster
Peters, M.	Peters	poster
Peterson, T.	Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart	poster
Quaisser, C.	Bartsch & Quaisser Quaisser & Haeuser	Poster Oral
Raman, S.	Starly, Raman, Cifelli & Davies	Oral
Randall, T.P.	Adrain, Maltas, & Randall	poster
Ranker, T.A.	Snow, Harbottle, James, Ranker, Thomas & Lorence	Oral
Rios, N.	Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart Rios & Bart	Poster DemoCamp

Russell, L.	Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart	poster
Russell, R.	Bryant & Russell Russell & Bryant Russell, Van Camp & Sheffield	Oral Oral oral
Ryder, S.	Ryder & Mendez	Poster
Schindel, D.	Schindel	Plenary
Schroer, C.	Mudge, Schroer, Lum Mudge, Schroer, Lum	Oral DemoCamp
Sheffield, C.	Russell, Van Camp & Sheffield	oral
Shuda, M.	Schuda & Neuhaus	Oral
Shugart, G.	Wimberger, Shugart & True	poster
Slawski, J.R.	Slawski	poster
Snow, N.	Snow, Harbottle, James, Ranker, Thomas & Lorence	oral
Spencer, C.L.	Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart Koo, Spencer, Cicero, Jarrell & McDonald	Poster DemoCamp
Stanley, G.D.	Moore & Stanley	poster
Starly, B.	Starly, Raman, Cifelli & Davies	Oral
Stimmel, H.	Blomberg, Freeland, Holland, Keil, Paige, Stimmel	poster
Telenius, A.	Telenius	Poster
Thomas, M.	Snow, Harbottle, James, Ranker, Thomas & Lorence	Oral
Thomer, A.	Thomer, Farrell, & McCune	Poster
Tomsett, L.	Tomsett	Poster
True, K.	Wimberger, Shugart & True	poster
Van Aken, A.	White, Jones, & Van Aken	Oral
Van Camp, A.	Russell, Van Camp & Sheffield	oral
Verveniotou, E.	Allington-Jones, Bernucci, Collins, Cornish & Verveniotou	poster
Vieglais, D.	Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart	poster
Wang, Z.	Dou, Hanken, Ludaescher, Macklin, McPhillips, P. Morris, R. Morris & Wang	DemoCamp
White, T.	White, Jones, & Van Aken	Oral
Wieczorek, J.	Spencer, Koo, Bloom, Cicero, Wieczorek, Guralnick, Peterson, Russell, Vieglais, Rios & Bart	poster
Wilbraham, J.	Wilbraham & Yesilyurt	poster
Wimberger, P.	Wimberger, Shugart & True	poster
Womack, K.	Molineux, Zachos, Criswell, Heron, Womack, & Chamberlain	poster
Yesilyurt, J.C.	Yesilyurt Wilbraham & Yesilyurt	Poster Poster
Zachos, L.	Molineux, Zachos, Criswell, Heron, Womack, & Chamberlain	poster
Zolnerowich, G.	Ferguson, Mayfield, Allen, Haddock, Maringanti, Oleen & Zolnerowich	Poster

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Michigan State University Museum

Tiffany Adrain
University of Iowa Paleontology Repository

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Carnegie Museum of Natural History

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University of Navarra

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California Academy of Sciences

Janet Bala
Idaho Museum of Natural History

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Arizona State University

Paige Bardolph
San Francisco State University Museum Studies Department

Teri Barry
San Jose State University Sharsmith Herbarium

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Museum of Natural History, Tulane University

Jan Beccaloni
The Natural History Museum, London

Elana Benamy
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Lori Benson
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Andy Bentley
KU Biodiversity Institute

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Botanical Research Institute of Texas (BRIT)

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Niccolo Caldararo
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Patrick Campbell
The Natural History Museum, London

Colleen Carter
Denver Museum of Nature & Science

Jules Carter
Amgueddfa Cymru - National Museum Wales

Ingela Chef Holmberg
Swedish National Heritage Board

Jovita C. Yesilyurt
The Natural History Museum

Liz Clevenger
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Chris Collins
Natural History Museum

Roger Colten
Peabody Museum of Natural History

Patricia Coorough Burke
Milwaukee Public Museum

Christina Cordova
Art Preservation Services

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Becky DeAngelo
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Jim Dolan
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Lei Dou
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John Dunphy
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University of Wisconsin Geology Museum

Laura Eklund
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Wayne Elisens
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Carolyn Ferguson
Kansas State University

Moe Flannery
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Chris Freeland
Missouri Botanical Garden

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Natural History Museum of Los Angeles County

Jean-Marc Gagnon
Canadian Museum of Nature

Erika Gardner
Rancho Santa Ana Botanic Garden

Rick Gardner
Carl Zeiss MicroImaging

Lydia M. Garetano
Bishop Museum

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Jo Hatton
Horniman Museum & Gardens

Andrew Haycock
National Museum Wales

Bob Henderson
Hollinger Metal Edge

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Gabriela M. Hogue
North Carolina Museum of Natural Sciences

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Rob Huxley
Natural History Museum

Christine Johnson
American Museum of Natural History

Rebecca Johnson
Encyclopedia of Life

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Florida Museum of Natural History

Lynn Jones
Yale Peabody Museum

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Chris Jordan
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