Entomological Collections Network

ECN

Annual Meeting

St. Louis, MO, USA

16-17 November 2019

http://ecnweb.org/

#ECN2019

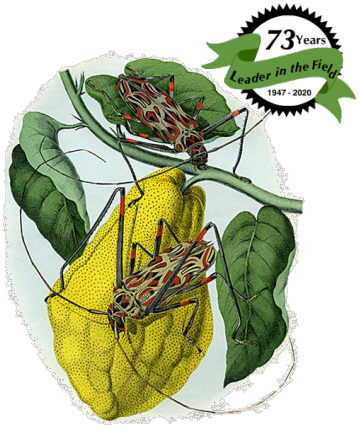
BioQuip PRODUCTS SINCE 1947

Celebrating 73 Years of Service to the Entomology community

BioQuip Products would like to thank our customers, friends, and the ECN community for all of the support and encouragement over the past 73 years.

Entomology is one of the most important sciences of our time. Where would the world be without you? The important work you do insures future generations will have the opportunity to appreciate the true diversity of the earth's insects, and their natural history. BioQuip applauds your passion for the preservation of insect collections.

We welcome the opportunity to continue serving you and the science of entomology. If you have any product needs or ideas that BioQuip can assist you with, please contact us. Together we can continue to support entomology by curating the world's insect collections, and providing the equipment and tools needed to perform this important work.



Check out our new and improved website at: *www.bioquipinc.com*

www.bioquip.com | 310.667.8800 | 310.667.8808
2321 Gladwick St. Rancho Dominguez, 90220

BioQuip BUGS

Over 3.5 million insects & other arthropods from around the world are in stock!
Limited live specimens are available.
Visit: www.bioquipbugs.com

ACKNOWLEDGMENTS

Thank you so much to our corporate and institutional sponsors and their continued generosity in helping our meetings be successful. Our members and officers greatly appreciate their support.

BioQuip Products, The Coleopterists Society, Delta Designs Ltd., Furth Museum Consulting, HH Elements, International Society of Hymenopterists, The Lepidopterists' Society, Macroscopic Solutions, Majkowski Woodworking Company, Species File Group

Thank you also to our personal sponsors for their continued generosity from 2018 and 2019 (in alphabetical order)
Victoria Bayless, Richard L. Brown, William Clark, Peter Cranston, Terry Erwin, Mike Ferro, Dave Furth, Henry Hespenheide, Lynn Kimsey, Jacqueline Miller, Floyd & Shannon Shockley, Derek Sikes, Katherine Tauber, and Guanyang Zhang

ECN 2019 Organizers: Max Barclay, Crystal Maier, Christy Bills, Isabelle Betancourt, Chris Grinter, Gene Hall, and Patrick Gorring

Cover Photograph: by Isabelle Betancourt

ECN Social Media Team: Isabelle Betancourt, Jennifer C. Girón,

Program layout and design: Chris Grinter & Gene Hall

We are also very thankful for our continued partnership with **iDigBio** and the **SysEB** section of Entomological Society of America (ESA).

Entomological Collections Network

Annual Meeting

Saturday November 16th and Sunday November 17th, 2019

Marriott St. Louis Grand

800 Washington Street, St. Louis, Missouri

#ECN2019 http://ecnweb.org/

SATURDAY, NOVEMBER 16TH

Marriott St. Louis Grand

Landmark Ballroom 1, 2, 3

7:00 am - 8:15 am Registration and Coffee

8:15 am - 8:30 am Welcome and Announcements

CONTRIBUTED TALKS SESSION 1

Moderator/Timekeeper: **Tommy McElrath**, *Illinois Natural History Survey, Champaign, IL, USA.*

8:30-8:48 am

From documenting diversity to monitoring ecosystems: Entomological growth at the Arizona State University Biocollections, with an introduction to the NEON Biorepository

M. Andrew Johnston, Emmy L. Engasser, Sangmi Lee, Nico M. Franz
Biocollections and Biodiversity Knowledge Integration Center, Arizona State University, School of Life Sciences, PO Box 874108, Arizona State University, Tempe, AZ, USA

The Arizona State University (ASU) Biocollections, located in Tempe (Arizona), represent the union of the ASU Natural History Collections and, since the Fall of 2018, the primary, long-term National Ecological Observatory Network (NEON) Biorepository. A mix of traditional and novel categories of holdings, research foci, and expanding infrastructural and personnel resources – particularly with regards to informatics development and data portal hosting services – are positioning the ASU Biocollections as an international hub for specimen-based biodiversity research. Following a brief overview, we will focus in particular on new holdings and developments for the ASU Hasbrouck Insect Collection and

O'Brien Collection integration (on-line @ https://scan-bugs.org); and then more thoroughly on the NEON Biorepository (on-line @ https://biorepo.neonscience.org). For a projected 30-year project span, the NEON Biorepository will receive some 105,000 samples annually, pertaining to 45 main sample classes and originating from 47 terrestrial and 34 aquatic sites. Roughly 70% of these samples will be cryo-preserved for genomic analysis. Entomological sample categories include pinned carabids and culicids, aquatic macroinvertebrates, and some 4,000 annually sampled pitfall trap bulk collections that generally contain well over 100 arthropod specimens per sample. Increasing the discoverability of these samples, lowering the threshold for use, and integrating their usefulness to ecological monitoring and forecasting with that of the more conventional, discovery-driven natural history collections – are focal activities to make the NEON Biorepository successful. We will review current opportunities to access the samples and associated data directly and in the context of research proposals and grants.

8:48-9:06 am

Documenting Collections Use: The 2018 Science Report of the Canadian Museum of Nature

Robert Anderson, Jeff Saarela & David Shorthouse
Research and Collection Division, Canadian Museum of Nature, Ottawa, Canada

Like almost all museums, the Canadian Museum of Nature (CMN) prepares and publishes a corporate annual report highlighting museum activities and accomplishments. In such reports, the attention given to research activities and details of collections use is often meagre. During my temporary appointment during late 2018 as Vice President, Research and Collections, and using the Science report of the Global Biodiversity Informatics Forum as a model, we proposed that the CMN R&C division prepare and publish a separate annual report, focusing only on the Research and Collections division, providing details of publications, collections use and impact, thematic representation, etc. Using a scientific publication-tracking tool developed by David Shorthouse using Google Scholar, the GBIF literature tracking tool and old fashioned manual searches we compiled a list of 255 publications published in 2018 by museum staff and associates and/or enabled by the museum's collection. Countries of first authors were identified and tabulated as a means of demonstrating global reach, nature of association with the museum (staff, associate, collaborator, visitor) was established, and the main subject of the publication was assigned to one of four themes; Earth History and Evolution, Environmental Health, Species Discovery, and Endangered Species and Conservation. A small subset of papers with greater real or potential impact were profiled in more detail for each of these themes. The value of such reports for demonstrating the importance of

research, and especially collections, for public outreach, potential donor interest, grant preparation, Board of Trustee education, etc. is discussed.

9:06-9:24 am

Curation and collections as scholarly work: an argument in defense of museum-centric publications and improved citation practices

Christopher J. Marshall
Oregon State Arthropod Collection, Oregon State University, Corvallis, OR, USA

Museum curation is a poorly understood profession even within the academic fields that benefit most from access to, and use of, well curated collections. This talk will present the idea that part of this misconception lies in a failure to recognize collections, and many of the curatorial activities taking place in them, as scholarly works in and of themselves. Even a single specimen represents a small, but real, contribution to mankind's collective body of knowledge. However, museum related scholarship does not end here. The collection itself represents a scholarly product greater than the sum of its parts, with curators often making decisions as to what specimens and types of specimens make up the collection. Integration of new or different research findings, in the form of re-determinations and/or novel classifications also represent scholarly activities that are conveyed via modifications/improvements to the collection itself. Lastly, in our day and age, curators participate in the field of museum science, an allied field to library science, that involves developing novel forms of object conservation as well as means to store and share information about those objects. I will further suggest that museum-centric publications, in conjunction with improved citation practices, could offer the means to share these scholarly accomplishments among ourselves as a community of museum curators while also providing an archived historical record of a collection/museum over time. Of note, a by-product of creating a published citable record related to various aspects of the collection, is the possibility that researchers making use of the collection could directly cite these publications, thereby allowing museums to be reflected in the bibliographies of downstream scholarly work that relies on the scholarly products inherent to the museum.

9:24-9:42 am

Once in a lifetime: re-curating the SEMC's Cerambycidae, a premature example of curation as intellectual product

Zack Falin
Division of Entomology, KU Biodiversity Institute, Lawrence, KS, USA

This spring, I undertook an opportunistic project to re-curate the SEMC's

Cerambycidae. Its scope eventually expanded to include vetting and updating the taxonomy of the entire family, identifying as much of the un- and partially determined material as reasonable, vetting and re-cataloging the types held at the SEMC and retroactively capturing specimen data for an *ad hoc* subset of the collection. Although not originally conceived or executed with a formal publication or report in mind, it became clear that, appropriately documented and formatted, the data generated from the project could prove valuable to current and future curators and staff, to the longhorn and coleopterological communities in general, and to myself as an unambiguous professional achievement. Some of the preliminary results of this project are that the SEMC now holds representatives of four families (Cerambycidae, Disteniidae, Oxypeltidae, and Vesperidae) and 11 subfamilies of longhorn beetles. Using the Cerambycinae as an example, the identification of 785 specimens increased the taxonomic representation within the subfamily to 59 tribes (an increase of 8.6%), 284 genera (+21.5%), and 676 species/subspecies (+19.5%). Primary and/or secondary types were vetted for 27 taxa within the Cerambycidae *sensu strictu*, including three type taxa previously missing from our type catalog and the discovery of two subspecies not listed in L. Bezark's online catalog. Determination data for 937 previously digitized specimens were updated while 481 digital specimen records were created *de novo*, increasing the total number of digitized specimens to 4,444, approximately 20% of the total longhorns in the SEMC. New geographic records were not noted, but the improvement in digitized data will hopefully reveal new and interesting distributional patterns going forward. Thoughtful, proactive documentation rather than retroactive analysis of the results will make reporting on future projects considerably easier.

9:42-10:00 am Who Uses Our Collections?

Max Barclay & the NHM Coleoptera Curatorial Section
Natural History Museum, London, UK

'Scientific outputs' are often used as a justification for access to natural history collections, or indeed for their existence. This makes it surprising that rates of citation in the scientific literature are rarely, if ever, used as performance indicators. Numbers of loans and visitors are common metrics, but what the visitors and borrowers actually do with the specimens is generally not measured. We discuss more than a thousand literature citations of the NHM beetle collection, and how they can show what kinds of science our insect collections can generate. Revealing the huge amount of science yielded by collections can also help justify institutional investment in Collections Management staff.

10:00-10:15 am coffee break

CONTRIBUTED TALKS SESSION 2

Moderator & Timekeeper: **Chris Grinter,** *California Academy of Sciences, San Francisco, CA, USA*

10:15-10:33 am — Suction trap network in the USA Midwest

Doris Lagos-Kutz[1], Joseph LaForest[2] and Glen L. Hartman[1]
[1]*United States Department of Agriculture-Agricultural Research Service, University of Illinois at Urbana-Champaign, Urbana, IL, USA*
[2]*Department of Entomology, Center for Invasive Species and Ecosystem Health, University of Georgia, Tifton, GA, USA*

The Suction Trap Network (STN) was initially established in Illinois by Dr. David Voegtlin in 2001. In 2005 the STN expanded to include sites in Indiana, Iowa, Michigan, Minnesota and Wisconsin. A few years later, the network expanded again to include Kansas, Kentucky, Louisiana, Missouri and South Dakota. Most of suction trap locations were placed on university research farms. The initial objective of the STN was to monitor the invasive soybean aphid species, *Aphis glycines*. The STN function includes i) providing information on counts of the soybean aphids and other aphid species on other crop pests, ii) generates data for collaboration with other researchers and iii) provides information for outreach through online and extension activities. The STN currently (2019) has 31 suction traps in operation. The suction traps are 5.8 m high and capture winged-insects through the suction of air through the standing pipe into a 250 ml bottle filled with 80 ml of a mix 1:1 of water and propylene glycol. The samples are collected and mailed weekly to a USDA-ARS laboratory located at the University of Illinois. Records of aphids collected in the suction traps from 2005 to 2018 were databased and available at the Suction Trap Network website (https://suctiontrap-network.org/). This website is supported by the University of Georgia Center for Invasive Species and Ecosystem Health ("Bugwood Center").

10:33-10:51 am — Avoiding the riff-raff: modified Malaise sampling for the collection of aphid parasitoids.

Abigail P. Martens, Paul J. Johnson
Insect Biodiversity Lab, South Dakota State University, Brookings, SD, USA

We modified Townes-style Malaise traps using garlic mesh fabric to effectively restrict the influx of non-target "riff-raff," significantly decrease sorting time, and provide cleaner samples with undamaged specimens.

Aphidiine wasps (Hymenoptera: Braconidae: Aphidiinae) are tiny, sexy, interesting, and provide biodiversity and taxonomic challenges. Additionally, they provide biological control of native and invasive aphid species throughout the world. Presently, there are only 120 described species known from northern North America, with about 400 described and many more species new to science awaiting description throughout the world. Aphidiines are typically collected with active sampling methods like searching, sweeping and beating, and plant sampling which aids in establishing multitrophic relationships and biological associations, but often results in few specimens per site visited and poorly estimates local diversity and relative abundance in a short sampling period. Passive flight intercept sampling techniques are ineffective as currently used, and samples are often inundated with large quantities of non-target Diptera, Lepidoptera, and Coleoptera. These non-target organisms typically damage the wasps, make sorting difficult and time consuming, dilute preservative concentrations, and tiny wasps tend to be lost during removal of these non-target organisms. Our modification was tested in stereotypically sterile soybean fields, increased diversity by 700+%, provided hundreds of wasp specimens per sampling period, improved the quality of wasps from each sample, and generally mitigated most all of the negative values of Malaise traps for Aphidiine collecting.

10:51-11:09 am

The Wisconsin Insect Research Collection (WIRC) — doing more with less in a medium-sized entomological collection

Craig Brabant
Wisconsin Insect Research Collection (WIRC), University of Wisconsin-Madison, Madison, WI, USA

Startup costs for embracing newer technologies that facilitate the adoption of modern curatorial practices can sometimes be prohibitive for smaller collections with few resources. However, creative approaches can reduce the price of implementing such practices. For example, unique identifier (UID) tags with QR codes can be produced using free software and a standard laser printer, eliminating the need to purchase a dedicated label printer and paper. Modern 'smart' phones or tablets can be used in lieu of dedicated bar code readers as input devices for reading QR codes. Vinyl cutters, or computer-controlled cutting machines, are relatively low-cost hardware that can efficiently and accurately cut out unit tray, drawer, and cabinet labels. Templates can be created for common label sizes that are routinely needed. Labels cut with a vinyl cutter are uniform in size and the cutting process is typically much faster than using scissors or traditional guillotine- or rotary-style paper trimmers.

11:09-11:27 am

Progress in digitizing the Diptera and Odonata collections at the USNM

Torsten Dikow, Erin Kolski, & Jessica Bird
Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington DC, USA

The Smithsonian National Museum of Natural History (institution-Code USNM) houses the largest insect collection in the world with an estimated 35 million specimens. While progress is being made to make data from the collection accessible in digital form, the sheer size of the collection makes this task daunting without additional resources. Here, we provide an overview of the ongoing digitization of the Diptera and Odonata collections. Our goal is to provide research-grade digital data and images representing the collections and specimens to unlock the vaults of our immense collection through our data portal at https://collections.nmnh.si.edu/search/ento/. The Odonata collection has been databased at the specimen level in the early 2000s and we currently have 110,258 specimen records and 214 primary type records online. The collecting localities had initially not been georeferenced but we are working through the entire locality database to add coordinates focusing on the Nearctic fauna initially and so far 60,288 Odonata are georeferenced. The vast majority of the Odonata collection is stored in envelopes and we are exploring the potential to photograph each individual envelope/

specimen in collaboration with the Smithsonian Digitization Program Office (DPO, https://dpo.si.edu) in a mass digitization project. The idea is to use conveyor-belt technology from Picturae (https://picturae.com/en/), which is currently being used to photograph the USNM herbarium, to photograph this collection and make the images available on our data portal. The Diptera collection with some 3.2 Million pinned specimens provides other challenges. Currently, four federal agencies are sharing the responsibility for the curation, i.e., Smithsonian, USDA ARS, USDA APHIS, and USDD Walter Reed Biosystematic Unit, and in total 69,615 specimens and primary type specimen records are digitally available of which 37,588 include geographic coordinates. Here, we will focus on the taxa curated by the Smithsonian team, which represents 73 families and just over 1 Million specimens. We made an effort to database at the specimen level and georeference every family for which we have less than 100 pinned specimens. Our aim is to add high-resolution images of at least one representative species for these taxa in the future. These families will likely be rare in nature as well as collections and therefore we provide primary biodiversity data and images for important fly taxa such as the monotypic Natalimyzidae (http://n2t.net/ark:/65665/3c94c8295-0630-4e7b-8c6c-684271d02940, https://collections.nmnh.si.edu/search/ento/?q=qn+natalimyza). Furthermore, the orthorrhaphous Diptera families have been prioritized for specimen-level databasing and so far 16 of the 24 families in our collection, ranging from 23 to > 1,500 specimens, have been databased. Our daily digitization work includes specimens to be sent out on loan, specimens returned from older loans, Syrphidae species important for conservation assessment in the north-eastern US, type specimen photography for virtual loans, as well as project-based specimens and images for revisionary taxonomy. In another mass digitization project with DPO, we are discussing the possibility of digitizing the pinned Diptera type drawers to at least have one photo, albeit only a dorsal view, of the 24,150 primary type specimens present in our collection. In addition, we are currently photographing the remainder of the 1,043 Neotropical Tachinidae types described by Charles H.T. Townsend, who described hundreds of monotypic genera, using the semi-automated GIGAmacro Magnify2 system. In conclusion, while progress is slow given the size of the USNM collection, we are making progress in providing data on Odonata and Diptera on our portal as well as the Global Biodiversity Information Facility (GBIF, https://www.gbif.org).

11:27-11:45 pm Metamorphosis complete: Reintroducing the UMMZ Insect Collection after the big move

Erika Tucker
University of Michigan Museum of Zoology, University of Michigan, Ann Arbor, MI, USA

With an estimated 3.5 million insect specimens, the University of Michi-

gan Museum of Zoology (UMMZ) Insect Collection is a substantial collection with specimen holdings representing both national and international distributions. Extremely well represented groups in the collection include Orthoptera, Odonata, and Coleoptera, with Hymenoptera quickly catching up. The collection recently underwent a big move about 5 miles south of main campus, but finished in 2018 and is up and running! The UMMZ is now under new management and collection digitization and databasing efforts are in full swing. Museum volunteer recruitment is ongoing and the staff is actively providing outreach activities.

11:45-12:03 pm

A new life for an iconic collection: Promoting access to the Charles & Lois O'Brien Insect Collections at Arizona State University

Emmy Engasser, Salvatore S. Anzaldo, Haleigh L. Boulanger, Trinity M. Johnson, C. Kirk Malm, Avneet K. Nagra, Kelsie R. Wilder, Sangmi Lee, M. Andrew Johnston, & Nico M. Franz
Biocollections and Biodiversity Knowledge Integration Center, Arizona State University, School of Life Sciences, PO Box 874108, Arizona State University, Tempe, AZ, USA

In the Fall of 2018, the Arizona State University Biocollections acquired the entire Charles W. and Lois B. O'Brien Collections – possibly the largest privately held insect collection in the world, with an estimated 1.0 million weevil specimens (Coleptera: Curculionoidea; formerly CWOB, now ASUCOB) and 250,000 planthopper specimens (Hemiptera: Fulgoroidea; formerly LBOB, now ASULOB). Jointly these collections – approximately 1,260 fully curated drawers – are global in scope. They have been built up since the mid 1950s, with particular strengths in New World (tropical) taxa. The O'Briens' special relationship and unparalleled dedication to creating this legacy was beautifully documented in the 2019 movie "The Love Bugs" (thelovebugsfilm.com). With support from the National Science Foundation, the collections are entering a new phase of improved access at ASU through: (1) transition into new, Cornell-configured insect cabinets, drawers, and unit trays; (2) comprehensive recuration according to an internally consistent, current and well-documented classification; (3) targeted digitization – including both databasing and imaging – of Central American weevils in the family Dryophthoridae and subfamilies Conoderinae and Entiminae (all sec. Bouchard et al. 2011; https://doi.org/10.3897/zookeys.88.807); and (4) a diverse training and outreach program including a new collections-centric podcast series "Collectors Unknown" to be released later in 2019. The selective databasing is intended to establish occurrence-level distribution profiles for Central American weevil taxa last treated comprehensively in G.C. Champion's Biologia Centrali-Americana (1902-1911). A total of

16 under/-graduate students, volunteers, and visiting researchers have so far contributed to this enormous undertaking. As of July 1st, 2019, more than 11,000 pertaining to nearly 1,000 species have been digitized in SCAN; including 300 primary types from both collections (ASUCOB: http://scan-bugs.org/portal/collections/misc/collprofiles.php?collid=121; ASULOB: http://scan-bugs.org/portal/collections/misc/collprofiles.php?collid=168).

12:03-1:30 pm **Lunch**

MEMBER SYMPOSIUM 1

Specimen Preservation in the 21st Century: Getting the Most Data from Collecting Efforts

Organizer/Moderators: **Patrick Gorring**, *Michigan State University, Department of Entomology, East Lansing, MI, USA* and **Kojun Kanda**, *ORISE/USDA-ARS, Systematic Entomology Lab, Washington D.C.*

1:30-1:35 pm Introduction

Patrick Gorring[1] & **Kojun Kanda**[2]
[1]*Michigan State University, Department of Entomology, East Lansing, MI, USA*
[2]*ORISE/USDA-ARS, Systematic Entomology Lab, Washington D.C., USA*

1:35-1:50 pm Building an entomological cryo-collection: Insights from the NEON Biorepository

Azhar Palit Husain, **M. Andrew Johnston**, Nico M. Franz
Biocollections and Biodiversity Knowledge Integration Center, Arizona State University, School of Life Sciences, PO Box 874108, Arizona State University, Tempe, AZ, USA

Building a long-term cryo-collection for insects and other arthropod taxa requires substantial infrastructural, personnel, and informatics resources. In the Fall of 2018, the Arizona State University (ASU) Biocolllections became the primary, long-term National Ecological Observatory Network (NEON) Biorepository. A major component of this project is to create a high-volume, highly accessible cryo-storage facility; capable of accommodating up to 70,000 samples annually and for a projected three-decade duration. We here present current insights and considerations on the process of creating such a facility, focusing on the following issues: (1) Available types of cold-, ultra-low, and cryo-storage; (2) coordination between spatial curation, internal data management, and publication through the

NEON Biorepository data portal (https://biorepo.neonscience.org); (3) financial, infrastructural, and personnel requirements to implement selected storage types; and (4) implications for long-term cryo-storage and data integration for arthropod vouchers.

1:50-2:05 pm

Sequencing challenging specimens: balancing sequencing success and preservation of valuable DNA with small, old ground beetle specimens (Coleoptera: Carabidae)

John S. Sproul[1,2] and David R. Maddison[2]
[1]*Department of Biology, University of Rochester, 402 Hutchison Hall, PO Box 270211, Rochester, New York, USA*
[2]*Department of Integrative Biology, Oregon State University, 3029 Cordley Hall, Corvallis, Oregon, USA*

Although DNA sequences from dried, pinned specimens promise to be of value for many fields of research, DNA extractions of museum insects often yield only tiny amounts of degraded DNA. We explored sample preparation techniques and sequencing success of 16 small specimens of the ground beetle genus *Bembidion* and the related genus *Lionepha*, including several type specimens critical to resolving questions in carabid taxonomy. We report successful sequencing of study specimens ranging from several decades to 159 years in age, including material from LeConte (1853-1857), Bates (1878), and Casey (1918), using minimal quantities of input DNA. Despite our success at obtaining diagnostic sequences from most specimens, high levels of sequence degradation in two specimens prevented confident diagnosis. For these challenging specimens, we were able to use abundance patterns of repetitive sequences as molecular morphological characters, which allowed us to confidently place them to species. We present guidelines to facilitate more economical use of valuable DNA and enable more consistent results in projects that aim to sequence challenging, irreplaceable historical specimens.

2:05-2:25 pm

From bottle, to drawer, to bench: a summary of methods and processes for genomic DNA studies of microhymenoptera

Matt Buffington[1] and **Bonnie Blaimer**[2]
[1]*Systematic Entomology Laboratory, USDA-ARS, Washington, DC, USA*
[2]*NC State University, Department of Entomology and Plant Pathology, Raleigh, NC, USA*

Affordable and efficient genomic resources are becoming increasingly available for studies on the phylogenomics of insects. Here we review methods employed by the combined USNM Hymenoptera Unit for not only maximizing catch in the field, but also facilitating partial genome sequencing (e.g. ultra conserved elements) further down the research stream. As we typically work on small to very small insects, the methods we use are applicable to other small terrestrial arthropods. We also highlight the continued need to support and fund collections-based research in this era of genomic datasets.

2:25-2:40 pm

Target enrichment using historical specimens and PCR products as probes

Bruno de Medeiros[1], Sang Il Kim[1], Zhenyang Wang[1], Fabio Laurindo da Silva[2], Brian D. Farrell[1]
[1]*Harvard University, Department of Organismic and Evolutionary Biology and MCZ, Cambridge, MA, USA*
[2]*University of São Paulo, Department of Zoology, BRAZIL*

Dry insect specimens preserved in collections are a rich resource for genomic studies. Ideal methods should require only small amounts of starting material, resulting in minimal damage to specimens, and be able to handle potentially degraded DNA. Target enrichment, a method in which genomic libraries are enriched for certain parts of the genome prior to sequencing, has proved very promising in this context. One particularly inexpensive flavor of the technique consists in producing the DNA probes for hybridization in the lab, using PCR on one or a few well-preserved specimens, instead of ordering RNA probes. I will give an overview of the method and show how I used it to obtain data for several kinds of samples, including beetles, chironomids and mummified caterpillars attacked by fungi. I will also compare the quality of data obtained across samples of different ages and methods of preservation, and highlight some of the challenges in dealing with this kind of data.

2:40-2:55 pm Collecting Insects for Genomic Research

Maureen Turcatel
Field Museum of Natural History, Chicago, IL, USA

As the use of genomic approaches to resolve phylogenies and systematic questions become more popular and affordable, there is an increase in the demand for cryogenically preserved material in biological collections. The main methods to preserve insects for molecular work consist in keeping specimens in concentrated ethanol or in RNAlater, which may be refrigerated or not; and in the refrigeration of specimens, kept in -20°C and -80°C freezers or in liquid nitrogen tanks (-196°C to -210°C). Liquid nitrogen is by far the best option for long term storage of tissue and whole specimens of insects because it preserves both DNA and RNA, so the material is suitable for genome and transcriptome sequencing. Here, cryogenic preservation methods for entomological specimens are discussed, and notes from fieldwork expeditions using a portable tank of liquid nitrogen are presented.

2:55-3:10 pm To extract or not extract: thinking about best practices for incorporating dry specimens in molecular studies

Kojun Kanda
ORISE/USDA-ARS, Systematic Entomology Lab, Washington D.C., USA

With ongoing advances in DNA sequencing technologies, the vast stores of non-cryogenically preserved specimens housed in collections should be regarded as valuable sources for molecular data. However, before armies of enthusiastic molecular biologists descend upon insect drawers with disposable pestles and tubes, researchers and collection managers should establish best practices for selecting specimens to be sequence and bench-work protocols. In this talk, I will review the protocols I follow in sampling pinned beetles for molecular studies, and discuss factors I have observed, from specimen choice to extraction techniques, that seem to influence sequencing success. I will also discuss issues with sampling truly unique specimens such as holotypes, and thoughts on balancing potential damage to specimens with data recovery.

3:10-3:30 pm Discussion and concluding remarks

3:30-3:45 pm Coffee Break

MEMBER SYMPOSIUM 2

Giving Voices to Our Specimens: Vignettes from Myriad Chapters in our Entomological Collections

Organizer/Moderator: **Dan Young**, *University of Wisconsin-Madison, Madison, WI, USA*

3:45-3:50 pm Session Introduction

Dan Young
University of Wisconsin-Madison, Madison, WI, USA

3:50-3:55 pm Stumped, but then not stumped, thanks to that stump (and a bit of frustration)

Dan Young
University of Wisconsin-Madison, Madison, WI, USA

3:55-4:00 pm Essays in the collection

Erica McAlister
Natural History Museum, London, UK

4:00-4:05 pm Coloration no more

Stylianos (Stelios) Chatzimanolis
Department of Biology, Geology and Environmental

Science, University of Tennessee, Chattanooga, TN, USA

4:05-4:10 pm — Stephan's riffle beetle (*Heterelmis stephani*): Extinction is not the end

Gene Hall
University of Arizona Insect Collection, Tucson, AZ, USA

4:10-4:15 pm — From the mummy wrappings of Wah, a 4020 year-old gryllid

Christine Johnson
American Museum of Natural History, New York, NY, USA

4:15-4:20 pm — Aquatic legacy: the Hilsenhoff Collection

Jacki Whisenant
University of Wisconsin-Madison, Madison, WI, USA

4:20-4:25 pm — The McMillan Cabinet of Insects and the creation of the A.J. Cook Arthropod Research Collection

Anthony Cognato
Michigan State University, East Lansing, MI, USA

4:25-4:30 pm	Lost and found and (maybe) lost again: Hawaii's loneliest fly **Karl Magnacca** *Bernice Pauhi Bishop Museum, 1525 Bernice St., Honolulu, HI, USA*
4:30-4:35 pm	The Teneb that broke Paul Johnson's heart **Mike Ivie** *Montana State University, Bozeman, MT, USA*
4:35-4:40 pm	Tiny revolutionaries overturn a megadiverse group **Margaret Thayer** *Field Museum of Natural History, Chicago, IL, USA*
4:40-4:45 pm	A life story written on entomological labels **Marcin Jan Kamiński** & Dariusz Iwan *Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw, Poland*
4:45-4:50 pm	A pet in every sense of the word **Natalie Dale-Skey** *Natural History Museum, London, UK*
4:50-4:55 pm	Under pressure: James Chapman's ants in the Philippines **Rachel Langston Hawkins** *Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA*
5:00-6:00 pm	**ECN Business Meeting**
6:15-7:30 pm	**ECN Mixer and Poster Session** *Poster Presenters should plan to be near posters for questions*
7:30-9:00 pm	**ECN Annual Banquet - Landmark Ballroom 4**

SUNDAY, NOVEMBER 17TH

Marriott St. Louis Grand
Landmark Ballroom 1, 2, 3

7:30 am - 8:30 am Registration and Coffee

CONTRIBUTED TALKS SESSION 3

Moderator/Timekeeper: **Gene Hall**, *University of Arizona Insect Collection, Tucson, AZ, USA*

8:30-8:48 am

A method for rapid cabinet-space assessment in the Museum of Comparative Zoology Entomology Collection

C. W. Farnum, E. Graham, Rachel Langston Hawkins, **Crystal A. Maier**
Museum of Comparative Zoology, Harvard University, 26 Oxford St., Cambridge, MA, USA

Here we present a method for rapidly determining the amount of expansion space present in an entomology collection (Museum of Comparative Zoology Entomology Collection), as well as an estimation of the overall need for expansion space and re-curation space in this collection. This method accounts for both interspecific expansion space (ensuring one species to one tray). We also present the results of this assessment including recommendations for allocation of space in the collection.

8:48-9:06 am

Standardization and Data Flexibility: Lessons Learned from Digitization of a Large Lepidoptera Natural History Collection

Laurel Kaminsky, Trudi Durgee, Erin Lapasaran, Victoria Tran, Anupama Priyadarshini, Akito Y. Kawahara
McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, Gainesville, FL, USA

Large new natural history collections are faced with many challenges. The McGuire Center for Lepidoptera and Biodiversity (MGCL) at the Florida Museum of Natural History (FLMNH) contains an estimated 3-10 million samples of butterflies and moths and is continuously acquiring hundreds of thousands of specimens annually from private and institutional donors. The MGCL was founded just over a decade ago from

merging the Allyn Museum, Florida State Collection of Arthropods and University of Florida collections. MGCL holdings include pinned Lepidoptera that have been reared as caterpillars or collected as adults, Riker mounts, caterpillars in ethanol vials, wing vouchers, molecular resources, and microscopic slides. MGCL does not have an institutional legacy database and is currently creating one in Specify that will contain images and transcriptions from all holdings. The MGCL digitization workflow includes imaging the dorsal and ventral sides of pinned adult butterfly and moth specimens and their labels. As a rapidly growing collection, one of the major challenges is how to quickly standardize and capture data of collection holdings while simultaneously trying to accession new acquisitions. We present progress on underwing moths (*Catocala*; approximately MGCL 30,000 samples) to illustrate how MGCL organizes image/transcription data, tracks the processing steps of each sample, and files into the collection. We use a simple, taxonomic, hierarchy-based file structure that minimizes nesting folders and provides information to track image quality. We use software to automatically read barcodes, and python scripts to automate image editing. We also discuss the challenges in data storage and how to standardize data from different sources (pinned insects, molecular holdings, Riker mounts, and caterpillars) to create a unified database.

9:06-9:24 am

Little brown beetles (Coleoptera: Cucujoidea) go digital: progress on the Cucujoidea Species File project

Tommy McElrath[1], Matthew Gimmel[2], Gareth Powell[3], Natalie Saxton[3]
[1]*Illinois Natural History Survey, Champaign, IL, USA*
[2]*Santa Barbara Museum of Natural History, Santa Barbara, CA, USA*
[3]*Brigham Young University, Department of Biology, Provo, UT, USA*

In 2018, the Catalog of Life (catalogueoflife.org,CoL) announced a series of small grants to help fill major gaps in their catalog coverage. The superfamily Cucujoidea (Coleoptera, Polyphaga) was one of these gaps, with less than 10% of the estimated 10,000 described species listed in the CoL, not including an estimated 5,000 invalid names and synonym relationships. Many of the 25 families have not had a worldwide catalog published in a century or more; massive changes in family composition during the modern era have made this even more of an issue. Using TaxonWorks (www.taxonworks.org) and an extensive network of collaborators, the authors set out to fill this gap in the Catalog of Life. We report on the progress made on this project and demonstrate the power of TaxonWorks as a collaborative catalog building tool.

9:24-9:42 am

Design and workflows for digitization of fluid-based larval insect collections

Erin Lapasaran, Victoria Tran[1], Laurel Kaminsky[1], James E. Hayden[2], Akito Y. Kawahara[1]
[1]*McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, University of Florida, Gainesville, FL, USA*
[2]*Florida State Collection of Arthropods, Gainesville, FL, USA*

Digitization of fluid-based entomological collections is generally more challenging than that of standard, pinned collections. Fluid-based collections can be difficult to digitize because the specimens are often preserved in vials, are preserved in different orientations, and often cannot be left outside of fluid for a long time. These collections also require containers that hold fluid and that maintain accurate lighting during imaging, barcodes on the outside and inside of vials for proper cataloguing, and may require the replacement of old fluid with new fluid. There are few published workflows for imaging fluid insect collections, with the

most recent being Mendez et. al. (2018). Their workflow used a flatbed scanner and 3D printed boxes. Here we present the digitization workflow that has been developed for the larval Lepidoptera collection at the McGuire Center for Lepidoptera and Biodiversity, which has an estimated 50,000 lot fluid collection. Our workflow utilizes a lightbox platform for imaging, and can be accomplished easily with two or three personnel. With the three digitizer approach, one person prepares the specimen, a second person images the sample, and the third places the specimen back into the vial and replaces the fluid. We demonstrate differences in specimen image quality in 3D printed plastic versus glass containers, and the difference in images between having fluid or no fluid. For barcode management, two copies of each data matrix barcode are printed on the same sheet. We also discuss challenges with affixing a barcode to the outside of the vial, and best practices for larval handling.

9:42-10:00 am

Digitization TCN: Terrestrial Parasite Tracker: Digitizing collections to trace parasite-host associations and predict the spread of vector-borne disease.

Kathryn Sullivan[1], Julie M. Allen[2], John Bates[3], James Boone[4], Craig Brabant[5], Sara Bush[6], Stephen Cameron[7], Mariel Campbell[8], Michael Caterino[9], Alyssa Caywood[1], Neil Cobb[10], Anthony Cognato[11], Julia Colby[1], Joseph Cook[8], Andrew Deans[12], Dmitry Dmitriev[13], Neal Evenhuis[4], Scott Gardner[14], Christopher C. Grinter [26], Robert Guralnick[15], Ralph Holzenthal[16], Johannes Klompen[17], Jessica Light[18], Istvan Miko[19], Anna Monfils[20], Barry O'Connor[21], Sarah Orlofske[22], John Oswald[18], Jorrit Poelen[23], Sandra Rehan[19], Daniel Rubinoff[24], Joyce Sakamoto[12], Katja Seltmann[25], Petra Sierwald[3], Robin Thomson[16], Michelle Trautwein[26], Erika Tucker[21], Christopher Tyrrell[1], Jason Weckstein[27], Michael Whiting[28], Daniel Young[5], and Jennifer Zaspel[1,7]

[1]*Milwaukee Public Museum, Milwaukee, WI,* [2]*University of Nevada, Reno, Reno, NV,* [3]*Field Museum of Natural History, Chicago, IL,* [4]*Bernice P. Bishop Museum, Honolulu, HI,* [5]*University of Wisconsin-Madison, Madison, WI,* [6]*University of Utah, Salt Lake City, UT,* [7]*Purdue University, West Lafayette, IN,* [8]*University of New Mexico, Albuquerque, NM,* [9]*Clemson University, Clemson, SC,* [10]*Northern Arizona University, Flagstaff, AZ,*

[11]Michigan State University, East Lansing, MI, [12]The Pennsylvania State University, University Park, PA, [13]University of Illinois at Urbana-Champaign, Champaign, IL, [14]University of Nebraska-Lincoln, Lincoln, NE, [15]University of Florida, Gainesville, FL, [16]University of Minnesota, St. Paul, MN, [17]The Ohio State University, Columbus, OH, [18]Texas A&M University, College Station, TX, [19]University of New Hampshire, Durham, NH, [20]Central Michigan University, Mount Pleasant, MI, [21]University of Michigan, Ann Arbor, MI, [22]University of Wisconsin-Stevens Point, Stevens Point, WI, [23]GloBI, Oakland, CA, [24]University of Hawaii, Honolulu, HI, [25]University of California-Santa Barbara, Santa Barbara, CA, [26]California Academy of Sciences, San Francisco, CA, [27]Academy of Natural Sciences of Drexel University, Philadelphia, PA, [28]Brigham Young University, Provo, UT, USA

Terrestrial arthropod parasites are responsible for economically critical issues in human health, wildlife conservation, and livestock productivity. From a scientific perspective, they represent a spectrum of intimate ecological interactions with vertebrates. Terrestrial Parasite Tracker TCN (TPT) will digitize 1.2+ million arthropod specimens representing taxa that are important ectoparasites and disease vectors of vertebrates in the U.S. This digitization effort will integrate millions of vertebrate records with vector and disease monitoring data, creating a novel foundation for integrative, long-term research. Our TCN is a collaboration of taxonomists and curators from 26 vertebrate and invertebrate research collections, as well as epidemiologists, ecologists, data-scientists, and biodiversity informatics specialists. TPT will educate scientific and public communities on the importance of collections and data literacy by partnering with natural history museums to develop science-focused lectures, exhibits, summer youth programs, and new online educational resources for teachers in underserved communities. Specimen images generated by TPT will be used for the development of a rapid ID tool for parasites accessible via an API website and smartphone applications. We plan to empower ongoing citizen science and public awareness campaigns with the tools to understand distribution changes of arthropod vectors and associated diseases due to climate change and global movement.

10:00-10:18 am Pakela hopeo: too many wasps in Hawaii

Karl Magnacca
Bernice Pauhi Bishop Museum, 1525 Bernice St., Honolulu, HI, USA

Hawaii is home to a large number of unique and remarkable insect radiations, many of which have still barely been described. The bethylid wasp genus *Sierola* has been largely neglected since a single monograph nearly 100 years ago. Recent intensive collecting and study of historic collection specimens have revealed extraordinary diversity on the small island of Oahu, with over 150 species endemic to an island of less than 600 square miles. Preliminary examination of collections from the other islands indicates that they are similar. This assemblage thus represents 10-15% of the total species in Bethylidae. But why are there this enormous radiation of this obscure genus in such a small area? I review some of the patterns of diversity and evolution that may have produced this group.

10:18-10:36 am The UNH Natural History Collections Complex

István Mikó, Donald S. Chandler
University of New Hampshire, Durham, NH, USA

The University of New Hampshire Collection of Insects and Arthropods (UNHC) was formally recognized in 1891 and is the third largest collection in New England. Prior to 1981 the collection contained 230,000 arthropod specimens. Since that time the collection has grown to nearly 700,000 specimens, tripling in size, and is the largest and most well-curated state university insect collection in New England, and third only to the 7.5 million specimens at Harvard University and 1,000,000+ at Yale University. The growth of the collection has been driven by intensive inventories of 10 unique and/or natural areas within the state, including the alpine zone of Mt. Washington, Seabrook sand dunes, The Bowl Natural Area in White Mountains National Forest, and Spruce Hole kettle bog near Durham, in addition to lowland forest in West Lebanon ME. The value of the collection is also highlighted by the loan activity and number of publications that included our material. In the past five years we have made 66 loans of a total of 27942 specimens to researchers around the world. In that same period 44 publications have resulted from the UNHC material. Digitization efforts at the UNHC were initiated in 1983 and have involved more than 100 undergraduate students over the last three decades. Although these ongoing efforts have produced valuable information, the holdings of the collection have been in part unavailable to researchers and the general public due to the lack of modern digitization efforts and outreach activities. The College of Life Sciences and Agriculture (COLSA) demonstrated its general support towards the UNHC and for its integration into UNH general curriculum

by hiring a collection manager/lecturer in 2018. New digitization efforts at the collection have been started in 2019 and are partially supported by NSF. COLSA has also invested into the development of a new Natural History Collections Complex by the renovation and 30% expansion of the collection spaces for both the Insect/Arthropod Collection and the Hodgdon Herbarium and the establishment of a shared open lab concept glass-walled exhibit space / classroom that will allow us to portray activities of natural history collections. New Hampshire does not have a natural history museum that that could serve as the basis for STEM field trips from the nearby school districts and other museum related outreach events. The new Nature History Collection Complex will fill this gap.

10:36-10:45 am coffee break

MEMBER SYMPOSIUM 3: Tales from the Field: Vol. 4

Organizers/Moderators: **Derek Woller** *USDA-APHIS-PPQ-Science & Technology Phoenix Lab, Phoenix, AZ, USA,* **Michael L. Ferro**, *Clemson University Arthropod Collection, Clemson Univ., Clemson, SC, USA*

Too often, it seems that a majority of scientists tend to be reserved when talking about the fun and enjoyment they have at work. On the other hand, depending on one's perspective, it might be said that mounting 10,000 specimens isn't all that fun. And, for that matter, neither is reviewing papers, databasing, cracking the whip on student workers, etc. BUT, if you're like us, spending some time out in the field makes it all worthwhile! Who hasn't had that moment out in nature where they had a life-changing encounter with an insect, came too close to death, encountered memorable locals, etc.? We bet EVERY one of you has at least one of these tales and we're hoping you can share it with us eventually. For now, though, sit back, listen, and enjoy these entertaining tales from the field told by those who have dared to enjoy their jobs (maybe a little too much in some cases). In case you're curious, story abstracts have been withheld to enhance your listening experience because spoilers are no fun!

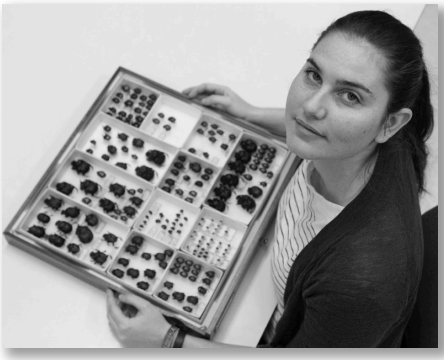
10:45-10:55 am Twenty-five years ago: Two intense years as entomologist in Rwanda.

Luc Leblanc
University of Idaho, William F. Barr Entomological Museum (WFBM), Moscow, ID, USA

10:55-11:05 am	Close calls in the Dominican Republic: Tangles with the police and near death from hypothermia and lightning **Derek S. Sikes** *University of Alaska Museum, University of Alaska Fairbanks, Fairbanks, AK, USA*
11:05-11:15 am	Badass Bots. Fun with Oestrids. **Erica McAlister** *Natural History Museum, London, UK*
11:15-11:25 am	No hablo español: six weeks on Hispaniola and Puerto Rico **Oliver Keller** *University of Florida, Gainesville, FL, USA*
11:25-11:35 am	Field Sketches: Adventures in the Wisconsin Wilderness **Jacki Whisenant** *University of Wisconsin - Madison, Wisconsin Insect Research Collection (WIRC), Madison, WI, USA*
11:35-11:45 am	Beetles, snakes, and feathers **Rolf L. Aalbu** *AKIS Consulting, California Academy of Sciences & UC Berkeley, Berkeley, CA, USA*
11:45-12:00 pm	**ECN Annual Meeting Concluding Remarks**

THE COLEOPTERISTS SOCIETY

www.ColeopSoc.org



Plenary Speaker
Nicole L. Gunter
Presents **"Beetles and Biogeography of a Great Southern Land"**

Annual Meeting this Tuesday evening November 19th

America's Center
Meeting Room 130
8:00 pm

Coffee, Tea, Snacks
7:30 pm

Everyone is welcome to attend – membership not required!

Annual membership for The Coleopterists Society is only $40 and includes a subscription to The Coleopterists Bulletin – join at our exhibit booth or through our website

CONTRIBUTED POSTERS

Poster sessions run throughout the meeting from 7:30 am on Saturday, November 16th through 12:00 pm on Sunday, November 17th. Poster presenters should stand with their posters during the mixer on Saturday evening to answer questions. Posters must be removed no later than 1:00 pm on Sunday afternoon.

Posters are listed here in alphabetical order by last name of the presenting author.

POSTER 1 Does your institution's entomology collection have a species index? Survey results

Isa Betancourt, Jon K. Gelhaus
Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA

A species index of a natural history collection helps with collection care, collection navigation, grant applications, and research inquiries. While maintaining a species index has been common practice for many types of natural history collections, for entomology collections it has historically been a less common practice. However, this is changing. In February 2019, we sent out a survey through the Entomology Collection Network listserve to collect information on how many collections have completed a species index of their holdings. Of the 68 collections represented in the response pool, one third reported having a complete species index. Of the completed species indices, nearly all are in digital format and about half are available to the public. Responses from over half of the collections without a complete species index indicated that there are ongoing indexing projects in the collection, suggesting that creating species indices is valued and a priority in entomology collection management. The survey responses also suggest that specimen quantity, funding, and manpower are limiting factors to indexing progress.

POSTER 2 One Room Schoolhouses - an untapped resource for entomological sampling in remote areas

Cheryl Fimbel, Zoe Pritchard, Casey Delphia & Michael Ivie
Montana Entomological Collection, Montana State University, Bozeman, MT 59717, USA

As part of the (Wild) Bees of Montana Project, we have sought ways to combine public engagement with under-served populations with increased sampling of under-represented areas. Montana's one room schools provide an opportunity to combine these goals.

POSTER 3

Integrating organismal data over time and space: a case study with *Oarisma poweshiek* (Lepidoptera: Hesperiidae)

Lillian Hendrick[1], Michael Belitz[1], Rachel A Hackett[2], Anna K Monfils[3], Dave Cuthrell[2], Michael J Monfils[2], Blake C Cahill[3]
[1]*University of Florida, Gainesville, Florida, USA*
[2]*Michigan Natural Features Inventory, Lansing, Michigan, USA*
[3]*Central Michigan University, Mount Pleasant, Michigan, USA*

Oarisma poweshiek (Lepidoptera: Hesperiidae), was a historically common, but now federally endangered species of prairie skipperling. We have developed a comprehensive dataset aggregating field, occurrence, and specimen based records and published it onto iDigBio for use in future studies. Here, we discuss the workflow for the digitization and data management to fully incorporate the accumulated Poweshiek skipperling records into one dataset.

POSTER 4

Incorporation of Computer Scripting into Digitization Workflow Enables Batch Renaming of Files and Decreases Data Processing Time

Aaron B. Leopold, Michael J. O'Connell, Laurel Kaminsky, Akito Y. Kawahara
McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, University of Florida, Gainesville, FL, USA

One of the key problems of digitization of natural history collections is how to minimize repetitive tasks. A collection has to repeat a set of processes to digitize each specimen. This include prepping the specimen, barcoding, imaging, renaming the image, editing the image, transcribing, and georeferencing. Finding ways to shorten the time interval for each process or even a step within one of the main processes greatly adds up. Solutions to decrease digitization time may require computer science expertise, which is often lacking at natural history institutions. The McGuire Center for Lepidoptera and Biodiversity (MGCL) at the Florida Museum of Natural History has approximately 3-10 million Lepidoptera specimens and is rapidly accumulating new specimens. Automating digitization processes is crucial to enable further digitization and to organize digitized data. Here we present three ways that we have incorporated computer science into our digitization workflows: batch renaming using a script to read the specimen's data matrix barcode, scripts that check the

quality of each image, and scripts to organize data and record processing status. First we implemented a python script that renames the raw and jpg copy of each image at the same time. The script scans the image for the data matrix code and then renames each image. Second, we utilize scripts to check the image quality and apply blurriness correction as needed. Lastly we use scripts to keep track of the processing status (edited, transcribed, georeferenced etc.) of each folder. In conclusion, there are many ways that digitization can be automated to give collection managers more control to manage the collection's data, and to increase digitization speed and efficiency. Working with computer scientists is crucial to create optimized workflows.

POSTER 5

How does climate affect worker body size variation in North American bumble bee species?

Alaina Michaels, Anna Dornhaus
University of Arizona, Tucson, AZ, USA

Within social insect worker castes, size polymorphism is prevalent across taxa and is often attributed to division of labor within a colony. However, bumble bee workers exhibit a large range of body sizes that has not fully been explained by division of labor. Some loose task specialization based on body size has been shown, where larger workers are more likely to be foragers and smaller workers are more likely to perform in-nest tasks. It has also been shown that this body size variation is not the result of inherent constraints of the colony, which supports that it may be benefiting the colony in some way. In this study, we include 33 North American bumble bee species using museum specimens to quantify body size variation in each species and examine differences in climate as a potential explanation for interspecific differences in body size variation. It has been shown that smaller workers are hardier against starvation than larger workers. We hypothesize that species with more variation will have native ranges in extreme climates. Having a more diverse worker caste could benefit these species found in variable environments compared to those species in more temperate climates.

POSTER 6

Progress of the Broward College Insect Collection: Current goals, focuses, and undergraduate research projects during our third year.

Giovanna Ortiz, David Serrano
Broward College, Davie, FL, USA

The Broward College Insect Collection (BCIC), founded in 2017, has offered undergraduate research projects and experimental learning oppor-

tunities to students that would otherwise not have these opportunities at a 100% teaching institution. Since the collection's inception, several undergraduate students in Broward College's Environmental Science Bachelors Program have been able to work on independent research projects that have contributed to the overall growth of the college's insect collection and our online database (SCAN/iDigBio). Details of the BCIC's progress, total SCAN/iDigBio specimen count, collaborations, and long-term survey projects will be presented.

POSTER 7 Comparing dry vs. wet preservation for instars of soft-bodied Archaeagnatha (Machilidae)

Jacki Whisenant, Samuel Degrey, & Dan Young
Wisconsin Insect Research Center (WIRC), University of Wisconsin-Madison, Madison, WI, USA

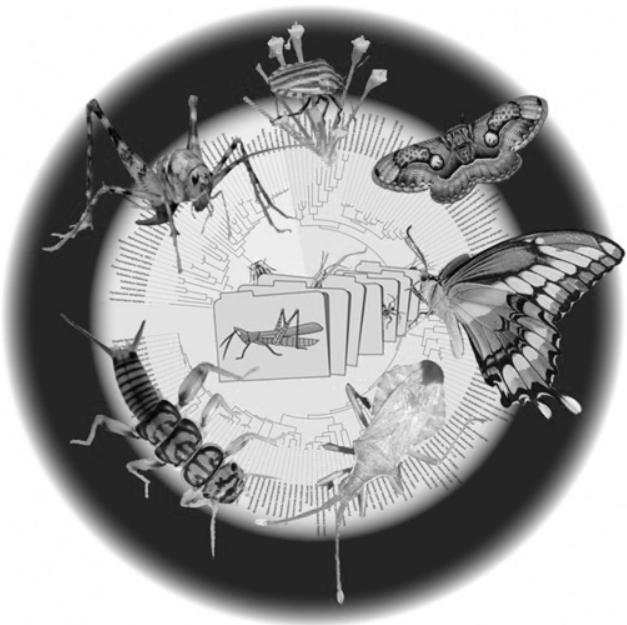
A comparison of photo-stacked images taken of specimens preserved in alcohol and specimens mounted on points after HMDS preparation, of various instars of archaeagnathans that have been collected in a series from one location over the summer period.

POSTER 8 Supporting Collections Sustainability: A Role for the NSC Alliance

Jennifer M. Zaspel [1,2], Robert Gropp[3], John Bates[4]
[1] *Department of Zoology, Milwaukee Public Museum, Milwaukee, WI, USA*
[2] *Department of Entomology, Purdue University, West Lafayette, IN, USA*
[3] *American Institute for Biological Sciences, Wash ington D.C., USA*
[4] *Integrative Research Center, Field Museum of Natural History, Chicago, IL, USA*

The Natural Science Collection Alliance is a Washington D.C.-based non-profit 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. NSC Alliance members are a part of an international community of museums, botanical gardens, herbaria, universities and other institutions that house natural science collections and utilize them in research, exhibitions, academic and informal science education, and outreach activities. The NSC Alliance links its members and the collections community to academic institutions, scientists, and other professionals in North America through meetings, policy advocacy, information sharing, and networking.

Species File Group



The Species File Group (SFG) is an endowment funded collective of specialists whose broader goals are the advancement of biodiversity informatics. We are located at the University of Illinois, Illinois Natural History Survey.
Our group supports the following software/activities:

- TaxonWorks, http://taxonworks.org, a workbench for taxonomists, lead by Matt Yoder & Dmitry Dmitriev.
- Global Names Architecture, http://globalnames.org, finding and resolving taxon names from literature, lead by Dmitry Mozzherin.
- Catalogue of Life, http://www.catalogueoflife.org, editorial group, and data assembly hub, led by Yury Roskov and Geoff Ower.
- Taxonomic/Systematic Research, supporting taxonomic research on Plecoptera (Ed DeWalt), Cicadellidae (Dmitriev), and micro-Hymenoptera (Yoder).

We provide modest grants to fill nomenclatural gaps (valid taxa, synonyms, homonyms, distribution) in the Catalogue of Life. This year we continue our focus on Coleoptera. Past winners are Thomas McElrath, Matthew Gimmel, and Gareth Powell working on Cucujoidea and Marcin Kaminski working on Sepidiini.

We encourage applications through the following form https://docs.google.com/forms/d/1F33LxYTMqjZO-S8t0v6SDTYCTo6WZ-12t1oFvDRZo6cE/viewform. Please apply by 31 December 2019. Applicants will be informed of our decision by January 15, 2020. If you have questions about your application, please contact Ed DeWalt (dewalt@illinois.edu).

Notes

Notes

Entomological Collections Network Code of Conduct

ECN seeks to promote a welcoming environment at our conferences that is safe, collaborative, supportive, and productive for all attendees. ECN values the diversity of views and backgrounds reflected among all attendees; as such we are committed to providing a positive environment for all, regardless of gender, sexual orientation, ability, religion, socioeconomic status, career status or ethnicity. All conference attendees are expected to adhere to the Code of Conduct.

Our respectful dialogue policy asks that participants make every effort to maintain constructive discourse with other conference attendees at all times. This includes speakers honoring designated time limits, attendees being aware of balancing speaking and listening time and welcoming newer members into conversation.

Expected Behavior

- Treat everyone with respect and consideration.
- Respect the rules and policies of the conference center and all venues associated with the conference.
- If you see inappropriate or disrespectful behavior or language, please speak up, either to the offender or conference organizers.

Unacceptable Behavior

- Harassment and intimidation, including any verbal, written, or physical conduct designed to denigrate, threaten, intimidate, or coerce another attendee, conference organizers or staff;
- Discrimination based on gender or gender identity, sexual orientation, age, disability, physical appearance, body size, race, religion, national origin, or culture;
- Physical or verbal abuse of any attendee, speaker, volunteer, exhibitor or service provider.

Consequences

- Anyone requested to stop unacceptable behavior is expected to comply immediately.
- ECN officers may take any action deemed necessary and appropriate, including immediate removal from the meeting without warning and without refund.
- ECN reserves the right to prohibit attendance at any future meeting.

Reporting Unacceptable Behavior

- If you are the subject of unacceptable behavior or have witnessed any such behavior, please immediately notify any ECN officer. You may text or call President Max Barclay (m.barclay@nhm.ac.uk) or Secretary Christy Bills (801-815-1852, cbills@umnh.utah.edu)
- For matters of immediate physical safety, you may also approach the venue security staff.

Systematics, Evolution, and Biodiversity Section

proudly supports
Entomological Collections Network

Tweet your experience at the meeting!

#ECN2019