

CENTER FOR BIOLOGICAL RESEARCH COLLECTIONS

May 1, 2019 - May 15, 2020

Center for Biological Research Collections – CBRC - includes two natural history collections:

- The IU Paleontology Collections (IUPC), housed within the Department of Earth and Atmospheric Sciences, hold > 1.5 million fossil specimens, including more than 1,000 unique type specimens, representing more than 400 million years of Earth's history. The IUPC holdings are global in their geographic scope but most are representative of the Paleozoic of North America, with many specimens from the State of Indiana.
- The William R. Adams Zooarchaeology Laboratory (WRAZL) is housed in the Department of Anthropology and includes over 10,000 modern comparative faunal remains inclusive of mammals, reptiles, amphibians and fish, and archaeological research projects from the North American Plains.

The IU Paleontology Collection and William R. Adams Zooarchaeology Lab are formal research repositories for natural history specimens. These specimens form the basis for research in paleontology, zooarchaeology, functional morphology, ecology and paleoecology, evolutionary biology, and related disciplines. The specimens are the primary sources of data on the structure and composition of organisms of the present and past, and they serve as tangible evidence that those organisms lived in particular places and times. Like archival research libraries, the material in these collections is used by researchers at IU and around the world. CBRC and the faculty and staff associated with the two collections thus carry out independent research on the collections, but also maintain their integrity and accessibility for the research community. This arrangement works in kind; faculty and staff at other universities and museums provide IU researchers with equivalent access to collections around the world.

CBRC is a pooled resource to support these collections and the faculty who are responsible for them. It serves as a vehicle for collaborative grants to enhance the collections and to support research; it maintains digital infrastructure such as collection management databases and digitization facilities; it provides training to faculty, graduate students, and undergraduates in collection based research methods and in collection care; and it facilitates access and use by researchers by providing support in locating specimens, processing loans, and linking specimens with associated data.

Director,

Claudia C. Johnson, Department of Earth and Atmospheric Sciences

Executive Committee Members

Laura Scheiber, Department of Anthropology, Director of WRAZL

P. David Polly, Department of Earth and Atmospheric Sciences

Collections Manager, Paleontology and Zooarchaeology

Jess Miller-Camp, Department of Earth and Atmospheric Sciences

Affiliate Members

Gary Motz, Assistant Director for Information Services, Indiana Geological & Water Survey

Governance

The Center is run by a Director and an Executive Committee consisting of faculty and research scientists who oversee IU's biological collections.

Operating Budget

The CBRC is funded by the College of Arts and Sciences, the Office of the Vice Provost for Research, the Department of Anthropology, and the Department of Geological Sciences.

The operating budget of 2019-2020 was allocated for staff, graduate and undergraduate student salaries, equipment repair, contractual services for equipment maintenance, consortium dues, institutional membership dues, and warranties for technical equipment for digitization of specimens. Full use of the undergraduate hourly part of the budget was interrupted in Spring 2020 by the global pandemic.

CBRC's Mission

The Center for Biological Research Collections (CBRC) is a consortium of research-based scientific collections at Indiana University.

The mission of the CBRC is to enhance collection-based research and education in biodiversity, zooarchaeology, paleontology, and related disciplines by providing shared infrastructural and data management support of IU's natural history collections.

The Center focuses on collections of biological specimens, including fossils and archaeological remains, that have shared taxonomic, geographic, and temporal metadata requirements. The Center coordinates policy, develops digital infrastructure, provides shared resources, facilitates educational outreach, and serves as a collaborative research platform for IU's biological and paleontological specimen collections.

CBRC develops external funding streams for upkeep and development of collection infrastructure, and it helps support data management and digitization for research grants that use IU's collections. CBRC's research collections are the focus of National Science Foundation and the Institute of Museum and Library Services awards.

The Center interfaces with partners to develop the specific digital infrastructure needed for biological collections. The Center collaborates with other collections to develop shared infrastructure and best practices. CBRC's partners include Heather Calloway and the University Collections office of Vice President for Research, the IU Digital Library Project, the IU University Information Technology Services (UITS), the Indiana Geological & Water Survey, the Glenn Black Laboratory of Archaeology, the Mathers Museum of World Cultures, the IU Advanced Visualization Laboratory, the Data to Insight Center of the IU Pervasive Technology Institute, and the IU School of Education.

Accomplishments in Student Research Training

CBRC has enhanced the teaching and research mission of Indiana University by training undergraduate students in laboratory work for the digitization of zooarchaeology and fossil specimens and their associated metadata, and graduate students in enhanced specimen research and in advising undergraduates on specimen-related, technological research procedures.

Seven undergraduates were paid museum assistants in the Fall semester, and one was paid through the Hutton Honors College. Students were taught to transcribe specimen metadata from slides, and to sort and identify plant fossils donated recently to the IUPC.

Graduate students participated in the process of data transcription, oversaw quality control, and instructed in the decision-making processes of the undergraduates' transcription work.

All of these students plus an undergraduate and two additional graduate students packed specimens and supplies as part of the IUPC partial collection move for the Geology Building renovation over the Fall 2019 and Spring 2020 semesters. While seemingly inconsequential, the proper procedure for

packing, securing, transporting physical specimens with their associated metadata is a valuable and essential skill for museum management.

One undergraduate completed a multi-year research project on invertebrate specimens known as brachiopods, including packing and handling specimens for transport to a facility in which 3-D scanning could be accomplished.

An additional undergraduate joined us through the ASURE geoscience class in Spring semester. Her class project was to take the plant fossil identifications previous students made, add her own, and learn how to do a scientific analysis and write and complete a scientific paper that focused on a paleoecologic analysis using biodiversity metrics to differentiate samples from two similar-looking rock formations from midwestern rocks.

One undergraduate documented, scanned, and illustrated the sloth bones for a thesis in the Individualized Major Program (IMP) in Underwater Archaeology and a certificate in Underwater Resource Management, using the 3D scanner at WRAZL. He presented his research at the IU Crossroads Conference, winning the best undergraduate poster prize.

One undergraduate examined ossification malformities in wombat specimens in the WRAZL collection, working with the Avian and Exotic Animal Clinic in Indianapolis to obtain comparative radiographs for use in this study.

CBRC OUTPUTS (2019-2020)

External Grants

In Progress:

- *National Science Foundation Research Grant, DBI-1702289.* 2017-2019. Digitization PEN: Paleoniches on the western Cincinnati arch, the Ordovician of Indiana. G. Motz (PI), C. Johnson, and P.D. Polly (co-PIs). (\$101,388).
- *Institute of Museum and Library Services Grant MA-30-16-0458-16.* 2016-2018, extension 2019. ACCESSioning at Indiana University: promoting digital access and (re-)discovery of the IU Paleontology Collection. Gary Motz (PI), P.D. Polly, C.C. Johnson (co-PIs) (\$112,505).
- *National Science Foundation Research Grant EAR-1338298.* 2013-2019. ELT Collaborative Research: Bayesian Paleoclimate Proxies – Transforming the Vertebrate Fossil Record. P.D. Polly (PI), K. M. Johnson, S. C. Brassell, and A. Schimmelmann (co-PIs), J. J. Head (Collaborative PI, U. Nebraska) (\$168,394).

In Review:

- *National Science Foundation Research Grant, RCN-UBE-2018765.* 2020-2025 proposal (submitted Jan 2020, in review) – The Natural History Organizations for (bio)Diversity and Education (NHODE) Network: Enhancing Undergraduate Biodiversity Education through Specimen Collections. K. Harris (PI), M. Anderson, J. Metzger, T. Marseco, J. Miller-Camp (co-PIs) (\$499,335).

Not funded:

- *Institute of Museum and Library Services, Inspire! Grants for Small Museums*. 2020-2021. Indiana Digital Atlas of Osteology. Laura L. Scheiber (PI), Jess Miller-Camp (co-PI). \$49,995. Not funded, working on revisions.
- *National Science Foundation, Dissertation Improvement Grants*. 2020-2021. Establishing a Framework of Dog Feeding Practices Using Dental Microwear Texture Analysis Indiana Digital Atlas of Osteology. Laura L. Scheiber (PI), Amanda Burt (co-PI). \$6,945. Not funded, working on revisions.

Internal Grants

In Progress:

- *John Barrett Patton Award* from the Department of Earth and Atmospheric Sciences. a departmental grant to fund continued work on the plant fossils. J. Miller-Camp (PI) (\$1500).
- *Indiana University Office of the Bicentennial*. 2018-2020. Owen Up to the Truth: Uncovering the Hidden History of *Megalonyx jeffersonii* to Engage in Indiana University's Natural History Collections. Polly Sturgeon (PI), Matthew Johnson, Gary Motz, Jennifer Lanman (co-PI's). \$25,000.

Not funded:

- Scheiber, Laura L. (PI) Indiana Digital Atlas of Osteology. Faculty Research Support Program, Indiana University. Co-PI's: Jess Miller-Camp, Claudia C. Johnson, P. David Polly, Gary Motz. \$40,000. 2019-2020. Not funded.

Publications

- Bethke, Brandi, and Amanda Burt (editors), 2020. *Dogs: Archaeology beyond Domestication*. University of Florida Press, Gainesville.
- Brimm, Thomas N.Z., 2019. Dive into Taíno History – Archaeology of the Caverns of the Dominican Republic. *Advisory Council on Underwater Archaeology Student Newsletter* (7)2:3.
- Fuentes-Gonzalez, J. A., P. D. Polly, and E. P. Martins. 2020. Uncertainty and modern phylogenetic comparative methods: a Bayesian phylogenetic ANCOVA. *Evolution*, 74: 311-325 (10.1111/evo.13899).
- Franco-Moreno, R. A., P. D. Polly, V. Toro-Ibacache, G. Hernández-Carmona, R. Aguilar-Medrano, E. Marín-Enríquez, and V. H. Cruz-Escalano. In review. Maximum feeding bite force in four pinniped species from the west coast of Baja California, Mexico, in relation to diet and feeding strategy. *Journal of Mammalian Evolution*.
- Goswami, A., A. Watanabe, R. N. Felice, C. Bardua, A.-C. Fabre, and P. D. Polly. 2019. High-density morphometric analysis of shape and integration: the good, the bad, and the not-really-a-problem. *Integrative and Comparative Biology*, 59: 669-683 (10.1093/icb/icz120).
- Kennedy, J. Ryan. 2019. Challenges and Opportunities with the Market Street Chinatown Collection. In *New Life for Archaeological Collections*, edited by Rebecca Allen and Ben Ford, pp. 199-225. University of Nebraska Press and Society for Historical Archaeology, Lincoln.
- Lintulaakso, K., J. Eronen, and P. D. Polly. 2019. Land mammals form eight functionally and climatically distinct faunas in North America but none in Europe. *Journal of Biogeography*, 46: 185-195.

- Phillips, R. P. L. Brandt, P. D. Polly, P. Zollner, M. R. Saunders, K. Clay, L. Iverson, S. Fei. 2019. Towards an improved understanding of the ecological consequences of climate change for Indiana forests. *Climate Change*. (10.1007/s10584-018-2326-8).
- Polly, P. D. Accepted. The assembly of cat communities in the New World: ecometrics and Neogene faunal turnover. *Geodiversitas*.
- Polly, P. D. 2019. Climate, diversification, and refugia in the common shrew: evidence from the fossil record. Pp. 407-454 in J. B. Searle, J. Zima, and P. D. Polly (eds.), *Shrews, Chromosomes and Speciation*. Cambridge University Press: Cambridge, United Kingdom (10.1017/9780511895531.014).
- Polly, P.D. and J. M. Wojcik. 2019. Geometric morphometric tests for phenotypic divergence between chromosome races. Pp. 336-364 in J. B. Searle, J. Zima, and P. D. Polly (eds.), *Shrews, Chromosomes and Speciation*. Cambridge University Press: Cambridge, United Kingdom (10.1017/9780511895531.011).
- Polly, P. D. 2019. Spatial processes and evolutionary models: a critical review. *Palaeontology*, 62: 175-195 (10.1111/pala.12410).
- Scheiber, Laura L. 2019. Trout Creek Archaeological Survey Summary Report of Investigations, Shoshone National Forest, Park County, Wyoming, BHA2019-1. Report submitted to the Shoshone National Forest District Archaeologist. Contributions by Thomas Brimm.
- Scheiber, Laura L., and Katherine L. Burnett. 2020. Writing Histories at Éngkahonovita Ogwêvi: Multicultural Entanglement at Red Canyon, Wyoming, USA. Accepted at *Antiquity*.
- Topalov, K., A. Schimmelmann, P. D. Polly, P. E. Sauer, and S. Viswanathan. 2019. Stable isotopes of H, C and N in mice bone collagen as a reflection of isotopically controlled food and water intake. *Isotopes in Environmental and Health Studies*, 55: 129-149 (10.1080/10256016.2019.1580279).
- Watts Malouchos, Elizabeth, April Sievert, Chris Beam, Melanie Pope, Eric Carlucci, Amanda A. Burtt, and Lauren Schumacher. 2019. Revealing Indiana University's Earliest Cultural Landscapes through Heritage Archaeology: The Results of Geophysical Survey and Excavation at the Wylie House Museum. Reports of Investigation 20-0, Glenn A. Black Laboratory of Archaeology, Indiana University, Bloomington. Report submitted to the Indiana Department of Natural Resources Division of Historic Preservation and Archaeology and the Indiana University Office of the Bicentennial.
- Zimmerman, A.N., Johnson, C. C., Bussberg, N. W., Dalkilic, M.M., 2020, Stability and decline in deep-sea coral biodiversity, Gulf of Mexico and US West Atlantic. *Coral Reefs*, <https://doi.org/10.1007/s00338-020-01896-9>
- Zimmerman, A. N., Brown, L. M., and Rexroad, C. B., 2019, A *Neognathodus*-based biozonation of the Desmoinesian Series (Pennsylvanian) in the Illinois Basin, USA. *Journal of Paleontology*, 93(4), 785-797.

Dissertations and Theses

- Ely, R., 2020. The relationship between ecological dispersion and morphological integration in Carnivora (Mammalia). M.S. thesis, Indiana University, Bloomington.
- Hellert, Spencer M., 2019. Locomotion Transitions and Sexual Dimorphism: Understanding the Causes of Phenotypic Integration Patterns. PhD Dissertation, Department of Earth and Atmospheric Sciences, Indiana University.
- Jenne, M., 2019. Modeling the etiology of coral disease in the Caribbean: Computational techniques for big disease data. Department of Computer Science, School of Informatics, Computing and Engineering, IUB.
- Kort, A.E., 2020. Evolution of lumbar and locomotion in Paleogene mammals. M.S. thesis, Indiana University, Bloomington.

Presentations

- Brimm, Thomas N.Z. “Dive into Taíno History: Underwater Archaeology in the Caverns of the Dominican Republic, Padre Nuestro,” Crossroads Conference, Bloomington, IN. (March 2019).
- Burt, Amanda A. “Ripe for Research,” Plains Anthropological Conference, Bloomington, IN. (October 2019).
- Burt, Amanda A., and Larisa R.G. DeSantis. “Unlikely Allies: Modern Wolves and the Diets of Pre-contact Domestic Dogs on the North American Plains and Rocky Mountains.” Society for American Archaeology Meetings, Albuquerque, NM. (April 2019).
- Burt, Amanda A., and Larisa R.G. DeSantis. “Zooarchaeology Analysis and Contending with Variation in Natural History Collections.” Indiana Academy of Science Annual Meeting, Indianapolis, IN (March 2019).
- Cook, K. J. 2019. Confounding Collections. Society for the Preservation of Natural History Collections Annual Meeting. Chicago, Illinois, May 2019.
- Fuentes-Gonzalez, J. A. Polly, P. D, Muñoz-Durán, J., Bartoszek, K., Pienaar, J. "Diet and Cranial Functional Morphology in Canids: Geometric Morphometrics and the Comparative Study of Adaptation", Ecological Society of America Annual Meeting, Louisville, KY. (August 12, 2019).
- Hawley, Kirsten M., and Laura L. Scheiber. “Spatial Data Analysis and Visualization Techniques of Shoshone Occupations in the Washakie Wilderness of Northwestern Wyoming.” Plains Anthropological Conference, Bloomington, IN (October 2019).
- Hawley, Kirsten, Laura L. Scheiber, and Amanda Burt. “Visualizing Mountain Shoshone Occupations in the Washakie Wilderness of Northwestern Wyoming.” Society for American Archaeology Meetings, Albuquerque, NM. (April 2019).
- Hellert, Spencer, P. David Polly, and Daniel P. Rhoda. “Evolutionary Constraint of The Diversification of Avian Limbs”. Society of Vertebrate Paleontology Annual Meeting, Brisbane, Australia. (October 2019).
- Kennedy, J. Ryan. “19th-century Chinese Migration and the Pacific World Fish Trade.” Fish Remains Working Group Meeting, Portland, OR. (August 2019).
- Kennedy, J. Ryan, and Leland Rogers. “A Piece of Salted Snakehead and Its Implications for the Nineteenth-Century Chinese Diaspora Fish Trade.” Society for Historical Archaeology Annual Meeting, St. Charles, MO. (January 2019).
- Kennedy, J. Ryan. “Zooarchaeological Perspectives on Tradition, Trade, and Entrepreneurialism in the 19th-Century Chinese Diaspora.” Syracuse University, Department of Anthropology. (October 25, 2019).
- Kort, Anne E., “An Early “Cat Gap”? An Evaluation of Oxyaenids as Ecological Analogues of Felids.” Society of Vertebrate Paleontology Annual Meeting, Brisbane, Australia. (October 2019).
- Miller-Camp, Jess. Patchwork Patterns and Widescale Worth: Small Paleontology Museums are Local Linchpins. Invited Participant in “No Collection Left Behind: Research Contributions of Small Collections.” Presented at the Society for the Preservation of Natural History Collections Annual Meeting, Chicago, Illinois, May 2019.
- Miller-Camp, Jess, and Cynthia Crane, Small to Mid-size Natural History Museums as Pillars of Their Communities. Presented at the Association for Materials and Methods in Paleontology Annual Conference, Hays, Kansas, April 2019.
- Miller-Camp, Jess. “Squee! Ahhh! What, no!? And Other Reactions to a Fuzzy Rock.” Society for the Preservation of Natural History Collections Annual Meeting, Chicago, IL. (May 2019).
- Polly, P. D. Integrative Anatomy Program, University of Missouri, “Functional traits, environments, and clades: at the interface of climate, ecology, and evolution”, 28 February 2020.

- Polly, P. D. Society of Integrative and Comparative Biology, Keynote Presentation in the Melding Modeling and Morphology Symposium, Austin, Texas, “The landscape of adaptive landscapes: trade-offs between performance surfaces in space and time”, 7 January 2020.
- Polly, P. D. Clara Jones Langston Centennial Lecture in Vertebrate Paleontology, Jackson School of Geosciences, University of Texas, Austin, “Hip deep in giant snakes, climate, environment, and the evolution of the vertebrate body plan”, 5 December 2019.
- Polly, P. D., Society of Vertebrate Paleontology Annual Meeting, Brisbane, Australia. "The assembly of cat communities in the New World: ecometrics and Neogene faunal turnover". (October 13, 2019).
- Polly, P. D. North American Paleontological Convention, Keynote Presentation in the Environmental Change and Evolution of Form and Function Symposium, University of California, Riverside, “Assessing form-function-environment interactions using ecometric analysis of functional traits”, 22 June 2019.
- Polly, P. D. North American Paleontological Convention, University of California, Riverside, “Paleontology and US National Monuments: Why downsizing Grand Staircase Escalante and Bears Ears is bad for science”, 22 June 2019.
- Polly, P. D. University of California Museum of Paleontology Award Lecture, “Spatial processes and evolutionary models: re-examining Gould’s Pleistocene snail from Bermuda”, 2 April 2019.
- Polly, P. D. New York Regional Primatology Colloquium, New York City University of New York, “Cycles and space: Interactions between evolutionary processes, trait sorting, and environmental change”, 7 March 2019.
- Polly, P. D. Guy F. Atkinson Distinguished Lecture, Geology and Geophysics, University of Utah, “Spatial processes and evolutionary models: re-examining Gould’s Pleistocene snail from Bermuda”, 31 January 2019.
- Polly, P. D. Yale Institute for Biospheric Studies, Yale University, New Haven, CT, “Cycles and space: interactions between evolutionary processes, trait sorting, and environmental change”, 25 January 2019.
- Rhoda, Daniel P., Spencer Hellert, P. David Polly. “Shifting Patterns of Functional Integration During the Evolution of Flight in Theropods.” Society of Vertebrate Paleontology Annual Meeting, Brisbane, Australia. (October 2019).
- Sturgeon, Polly R., and Gary Motz. “Don't Throw Your Specimens Out of a Window: Resurrecting IU's Lost *Megalonyx jeffersonii*.” Society for the Preservation of Natural History Collections Annual Meeting, Chicago, IL. (May 2019).
- Thorpe, E.D., and Zimmerman, A. 2019. Bringing microfossil specimens into the light: Using semi-automated digitization techniques to improve collection accessibility. Society for the Preservation of Natural History Collections Annual Meeting. Chicago, Illinois, May 2019.
- Zimmerman, A. 2019. Kit-bashing camera code: Lessons in developing auto-assist tools to compliment the GIGAMacro Photography System. Society for the Preservation of Natural History Collections Annual Meeting. Chicago, Illinois, May 2019.
- Zimmerman, Alex N., Johnson, Claudia C., Bussberg, Nicholas, Dalkilic, M.M. Leveraging machine learning to inform satial and temporal patterns in deep-sea coral biodiversity, Gulf of Mexico and US West Atlantic. Geological Society of America Abstracts with Programs, Phoenix, AZ.

Conference and Committee Leadership

77th Annual Plains Anthropological Conference. Bloomington, IN, October 16-19, 2019. Laura L. Scheiber, organizer; Amanda Burt, co-organizer; Thomas Brimm, committee member. WRAZL was one of the official hosts and sponsors of the conference.

Society of Vertebrate Paleontology Annual Meeting. Brisbane, Australia, October 9-12, 2019. P. P. David Polly, executive committee member; Jess Miller-Camp, program committee member, *Environmental Resilience Institute at Indiana University and Prepared for Environmental Change Grand Challenges Initiative*. Bloomington, Indiana, P. David Polly, Steering Committee.

The Collection Manager is also on the host committee for the annual, international *Digital Data in Biodiversity Collections* conference in June. Due to COVID-19, the conference has been changes from the IU campus to entirely online with IUB as the host institution.

Total Educational Offerings from CBRC Collections

- 217 specimens loaned for classroom use and research projects
- 21 courses with a total of 877 students using laboratory specimens, not including 100s of specimens used in-house by graduate and undergraduate students conducting research *in situ*
- 199 public visitors
- Outreach and collaboration with 22 educational and research entities

CBRC is not a degree-granting program or department

Major activities in 2019-2020 included:

Prepared the IU Paleontology collection for renovation of the Geological Sciences Building. CBRC faculty and staff redeployed digitization equipment to temporary locations, physically moved collection material to temporary off-site locations, prepared specimens and cases to weather disturbance during the renovation process, physically moved collection material within the building to temporary storage locations and labs; and physically moved teaching collections to classrooms around campus.

Completed redeployment of collection management database systems. CBRC operates the Specify database system, which is a specialized system for recording associated specimen data (taxonomy, sex, date and location collected, geologic age, storage location, etc.), accession information (documents that show the specimen was collected legally and belongs to Indiana University), loan processing, history of use, etc. CBRC maintains servers and software for both collections. We previously operated the system on local systems, but revised regulations required us to move it to an Intelligent Infrastructure Virtual Server, which presented various technical challenges. We completed the transfer this year with the help of UITS staff.

Completed two externally funded digitization initiatives. One project involved high-resolution digitization of our microfossil slide collection. These specimens are especially amenable to digitization because high resolution photographs capture most of what a researcher could observe from the specimen and because these fossils are broadly used by researchers (industry and academic) for studies of stratigraphy, paleoenvironment, and evolution. A grant to CBRC from the Institute of Museum and Library Services for \$112k allowed us to purchase a high resolution GigaMacro digital photograph system and employ students to carry out the work. The other project involved photography of a particularly important subset of the Paleontology Collection from the Ordovician Period, which represents the earliest steady increase in biodiversity in Earth history and the largest early mass extinction event. A grant from NSF for \$100k allowed us to inventory, catalog, and photograph our holdings from the western flank of the Cincinnati Arch which are especially extensive but have been historically

underutilized by the larger research community because their existence was not widely known.

Trained undergraduate and graduate research students in collection management. Three graduate students presented results of their research at the Society for the Preservation of Natural History Collections Annual Meeting. Chicago, Illinois, May 2019.

Highlights of CBRC accomplishments of major activities

- Completed entering element inventories into Google Forms for a total of 2,635 mammal inventories, 2,673 avian inventories, and 145 turtle inventories (this means the inventories of individual elements found per specimen – once associated with *Specify*, it will greatly increase our ability to tell researchers if we have certain elements available for study; i.e., Fuentes-Gonzalez's calcaneus study, Kort's lumbar study, Lubinski's hyoid study, Ascari's bird claw study – many researchers are interested only in specific elements found in an animal.
- Digitized all paper accession records from 1945 through current
- Started digitizing correspondence records
- Consolidated smaller avian specimens, reptiles, and fish, which improves ease of locating specimens by moving individually-boxed specimens into larger boxes grouped by species, and also improves overcrowding on shelves.
- Rehoused all of the nearly 2,000 fish specimens into new curation-stable boxes
- Reorganized invertebrate collections to allow better identification moving forward
- Photographed paper documentation found in the specimen boxes for all mammals, birds, and most of the reptiles. Renamed the photographs with catalogue numbers and ready to attach to *specify* – whenever we figure out how to do that.
- Digitized hundreds of slides of specimens in our collection to be added to *Specify*, hoping we can associate the photographs with individuals in the WRAZL collection
- Collated specimen location information for a pilot Indiana Digital Atlas of Osteology and developed a workflow for implementation. We will apply for funding again in 2020.

Future Plans

In keeping with CBRC's goal of advancing digital initiatives in all of our natural history collections, we aim to:

- Enhance graduate student utilization of research collections across the natural sciences
- Continue to instruct undergraduate students in specimen-based research
- Train students from diverse fields in digital museum management processes and techniques
- Advertise the value of specimens to enhance classroom student learning experiences across natural sciences, arts and humanities, and social and historical studies
- Continue fundraising efforts to support the Center's activities and personnel
- Develop research proposals for externally funded grants
- Connect with technical units to leverage digital support for collections
- Convene regular meetings with CBRC Executive Committee members
- Clarify organizational structure and governance

Special issues and challenges

I. COVID-19 brought work to a halt in the IUPC and WRAZL laboratories.

Many spring curatorial and digitization tasks could not occur because of restricted access and dispersal of undergraduate hourlies away from campus. These tasks included, among others, conversion of digital records for IU Paleontology into the Specify management system.

II. Renovation of the Geology Building required removal of specimens, and complete disruption of work within the laboratory.

Research access to collections was restricted for faculty and graduate students. Students in courses like EAS-E 562 Geometric Morphometrics were planning on using the collections to complete class projects, but had to make do with online images instead.

III. A comprehensive external review of the CBRC, the IU Paleontology Collection, and the William R. Adams Zooarchaeology Collection was to be scheduled for Spring 2021, to assess scholarly impact, progress in enhancing effectiveness, including digital initiatives, and levels of success in garnering external support.

Geology Building renovation and restoring collections in the IUPC, and recovery of operations from the COVID-19 pandemic will necessitate the review to be moved to a later date.