2018

2018 Annual Report

Christopher C. Witt
University of New Mexico

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Hundreds of visitors lined up at the CERIA building for MSB's annual open-collections event.
Overview
UNM's Museum of Southwestern Biology in 2018

In 2018, the Museum of Southwestern Biology (MSB) has continued to improve its profile and impacts, both on the University of New Mexico campus and in the international scientific community. Its collections serve as scientific infrastructure that enhances research, teaching, community service, and public outreach. The MSB is part of the UNM Department of Biology, and the missions of the MSB and the Department are synergistic. MSB houses extensive and rapidly growing collections representing biodiversity of world, primarily from the last half-century. MSB has outstanding collections from New Mexico and western North America, but it also has substantial holdings from five other continents around the world. MSB consists of eight divisions, and one special program (the Natural Heritage Program New Mexico). MSB also manages the large federal collection of the US Geological Survey collection, second only the Smithsonian Institution in size among federal collections. The collections enrich education by allowing for scientists, educators, public health professionals, and natural resource managers to investigate climate change, environmental quality, emerging diseases, invasive species, ecology, genomics, and evolution. The databases associated with the MSB’s eight collections constitute a significant, accessible informatics resource that grows in value each time scientific research is done using the collections. In these ways, MSB contributes to understanding life on earth, its origins, diversity, function, and relationships with human society and public health. MSB annual reports are archived and accessible via UNM's internet repository: [http://repository.unm.edu/handle/1928/24433](http://repository.unm.edu/handle/1928/24433).

The MSB Director works with division curators to align MSB's activities with UNM's missions in teaching, undergraduate and graduate education, basic and applied scientific research, and public service. In 2018, MSB showed high productivity in research, teaching, and curation. These specimens are used in diverse projects primarily in environmental and biomedical research, but they are also used by in other fields such as anthropology and art. Our collections formed the basis of 169 scientific publications in 2018. MSB personnel authored 59 scientific publications, including several in high impact-factor journals. The three-year average number of loans of physical specimens and their data to researchers and students is as high as it has ever been, reflecting the valuable collections growth that has occurred over the past few decades. MSB personnel also continue to bring in substantial extramural funding, with ~$1.8 million in grants and contracts that were active during 2018. Outside grants and contracts support basic research in ecology, genetics, and evolution, as well as applied research on conservation of rare species and the functioning of ecosystems on local, regional, and global scales. Our current MSB curators who have active research programs continue to build the collections as permanent scientific infrastructure, comprising an irreplaceable record of earth's environment at a particular moment in time. The research of our successful curators is
synergistic with these collecting activities, enhancing the reputation of MSB and UNM as sources of both scientific materials and new knowledge.

The Museum of Southwestern Biology enriches education for UNM students at the multiple levels. UNM students who have been involved at MSB experienced high-quality training and mentorship in data management, natural history specimen preparation, collections curation, and specimen-based research. 2018 was a productive year for student training. MSB personnel engage in hands-on, experiential teaching and learning, typically with credit hours flowing through the Department of Biology; however, we have been increasingly participating in the curriculum of the new Museum Studies Program, including providing *practicum* experiences. We also have many other collaborative relationships across campus. MSB staff members (eight full-time Collection Managers and eight faculty-curators) teach courses, provide specimens to other courses, and offer many opportunities for active learning. MSB is one of the fastest growing university-based natural history museums worldwide, and one of the biggest for certain collection types, such as mammals, parasites, and frozen tissues.

The infrastructure being established by MSB provides a unique educational resource that is marked by quality. These provide New Mexico students with opportunities to excel in biodiversity science, and our past students have demonstrated how they can use this as a springboard to success. MSB provides immersive training in biodiversity sciences and museum curation for UNM undergraduate and graduate students. This is reflected in successful employment outcomes for MSB Ph.D. graduates, and outstanding placement of MSB-affiliated undergraduate and M.S. students in high caliber Ph.D. programs. MSB-affiliated undergraduate and graduate students frequently go on to leadership positions in varied fields, from healthcare, veterinary science, high-tech industries, conservation, and resource management, to basic research. Active MSB Curators mentor high numbers of graduate students and our unit regularly leads the Biology Department in the number of students receiving doctorate or masters degrees. MSB Curators also mentor undergraduates in research. MSB-affiliated undergraduates win the department’s outstanding graduating senior award in most years (including in 2017 and 2018).

In 2018, MSB continued to exhibit leadership in public service and outreach, at UNM and in the New Mexico and global communities. MSB contributes to science-based management of natural resources in New Mexico and elsewhere through collaborations with government agencies (see active funded projects, pages 74–75). Through these funded projects, MSB supports municipal, county, state and federal environmental management agencies in various parts of the country. Many outreach efforts are related to developing effective management plans for state and federal resource agencies. International organizations also rely on our specimens, data and expertise to help them design and implement public health initiatives. MSB has built a strong tradition of identifying zoonotic pathogens (e.g., hantavirus) and discovering the life cycles, hosts, and transmission dynamics of zoonotic diseases and wildlife diseases in the western US and around the world. Vast spatial and temporal biodiversity data and one of the world’s largest frozen tissue collections make MSB an important and well-known resource for genomic and environmental bioinformatics.
This activity is recorded in the utilization statistics, contained in this report, for MSB’s online databases, specimen loans, and resulting scientific publications. MSB faculty and staff engage in collaborations with faculty in other UNM departments and colleges. For example, we have ongoing and long-term collaborative efforts with the School of Medicine and with the Arts and Ecology Program (College of Fine Arts), and Anthropology, Geography, History, and other disciplines. In 2018, for example, we joined an interdisciplinary team led by HSC investigators to study the impacts of concussion on woodpecker brains. Furthermore, in 2018, we took part in the proposal and planning stages for the renovation of a central UNM Main Campus building, the Bio Annex, as the Natural History Science Center, an effort that will continue in 2019 and is targeted for completion in 2020. This newly renovated building will house UNM’s Paleontology Collections in a large collections room, a fossil preparation lab, a specimen analysis lab, a museum-themed teaching and learning lab, and displays to communicate museum research. It will also house a staff office, a conference room, and dedicated graduate student office space. We participated in the design of this space with an eye toward spurring inter-museum and inter-departmental collaborations.

MSB personnel serve on national boards including the Board of Directors of American Society of Mammalogists, Flora of North America, Society of Ichthyologists and Herpetologists, Entomological Society of America, the American Ornithological Society, the New Mexico Ornithological Society, and the National Systematic Collections Alliance. The latter group, NSCA, is the primary advocacy group for administrators who oversee research-oriented natural history museums. NSCA is closely tied to American Institute for Biological Sciences in Washington, DC. MSB staff also serve on Steering Committees for several national initiatives, including VertNet, Arctosdb.org, Aim-Up!, and the Biodiversity Collections Network, a NSF sponsored Research Coordinating Network focused on translating the vast digital resources of natural history museums into a catalyst for greater research productivity and educational transformation in the US. In this way, MSB is the face of UNM for the global communities of biodiversity researchers, conservation biologists, and educators.

The staff of MSB provide its vital energy and are essential to its success. These include our eight Collection Managers. They also include our graduate assistants in each division, an administrative assistant, as well as extramurally funded staff, student employees, and volunteers. Faculty curators are responsible for staff management, performance evaluations, providing oversight, obtaining funding, and setting the vision, agenda, and goals to operate their respective divisions of MSB. In 2018, MSB, in collaboration with the College of Arts and Sciences, took positive steps to plan and advocate for improvements in compensation, workload equity, a promotion tiers for its Collection Managers and faculty curators; however, this work is still in progress, and serious issues remain to be solved in 2019.

Looking forward, 2019 is filled with potential for MSB, as we anticipate hiring a new Collection Manager for Fishes, searching for two new faculty curators (for the Herbarium, and Division of Amphibians and Reptiles, respectively), working toward improvements in our infrastructure, and continuing our groundbreaking research programs as they relate to biodiversity and global change.
1. DIVISION HIGHLIGHTS

By the end of 2018, the collection has increased by 481 specimens to a total of 100,066 cataloged specimens. The majority of specimens added in 2018 came from collaborators and students, with notable additions of tortoises from Arizona Game and Fish and material from the Albuquerque Biopark, thanks to a newly established formal repository relationship. The division’s website was visited 1,374 times to access information and we served over 12 million records via aggregator websites. The collection manager handled nearly 160 data requests in person and hosted several research visitors in the collection. Our outreach activities, in addition to general tours of the collection, included a variety of presentations and consultations. We presented on amphibians and reptiles to a varied public audience on several occasions. In addition, we gave presentations on ongoing research projects at regional meetings. This is in addition to a short-term project on Gila Monsters and a new collaboration with Western New Mexico University.
2. TABLE OF COLLECTION ACTIVITY

<table>
<thead>
<tr>
<th>Metric</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection Growth</td>
<td>481</td>
</tr>
<tr>
<td>Loans (outgoing (no. of specimens) / incoming (no. of specimens)</td>
<td>5/1</td>
</tr>
<tr>
<td>Specimen Records served via electronic databases</td>
<td>12,342,231</td>
</tr>
<tr>
<td>Publications using the collection</td>
<td>16</td>
</tr>
<tr>
<td>Citations of publications using the collection</td>
<td>770</td>
</tr>
</tbody>
</table>

3. EDUCATIONAL IMPACTS OF THE COLLECTION

3a. COURSES USING THE COLLECTIONS

BIOL 204, Animal Form and Function, spring and fall semesters, 277 students
BIOL 386, General Vertebrate Zoology, spring and fall semesters, 51 students
BIOL 488, Herpetology, spring, 14 students

3b. COURSES TAUGHT BY MSB PERSONNEL

<table>
<thead>
<tr>
<th>INSTRUCTOR(S)</th>
<th>SEMESTER</th>
<th>COURSE</th>
<th>TITLE</th>
<th>ENROLLMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNELL</td>
<td>Spring</td>
<td>BIOL 402 U 022</td>
<td>T: Conservation Biology</td>
<td>34</td>
</tr>
<tr>
<td>POE</td>
<td>Spring</td>
<td>BIOL 386L U 002</td>
<td>General Vertebrate Zoology</td>
<td>14</td>
</tr>
<tr>
<td>POE</td>
<td>Spring</td>
<td>BIOL 488L U 001</td>
<td>Herpetology</td>
<td>14</td>
</tr>
<tr>
<td>POE</td>
<td>Spring</td>
<td>BIOL 551 M 024</td>
<td>Research Problems</td>
<td>1</td>
</tr>
<tr>
<td>POE</td>
<td>Spring</td>
<td>BIOL 699 P 024</td>
<td>Dissertation</td>
<td>1</td>
</tr>
<tr>
<td>POE</td>
<td>Fall</td>
<td>BIOL 409 U 003</td>
<td>Phylogenetics</td>
<td>3</td>
</tr>
<tr>
<td>POE</td>
<td>Fall</td>
<td>BIOL 519 M 009</td>
<td>Phylogenetics</td>
<td>13</td>
</tr>
<tr>
<td>POE</td>
<td>Fall</td>
<td>BIOL 551 M 004</td>
<td>Research Problems</td>
<td>1</td>
</tr>
</tbody>
</table>

4. COLLECTION MANAGEMENT

During 2018 we continued our efforts to fully digitize the collection in the ARCTOS database, where over a third of our records are now directly available. In addition, we cataloged specimens from mostly New Mexico and bordering states that were deposited by personnel and close collaborators, notably those associated with Western New Mexico University and Arizona Department of Game and Fish. We focused our efforts on frozen tissues and curating the collection of now nearly 3,000 vials that store valuable material from corresponding specimens in the main collection. In addition to direct curation efforts (switching containers, labeling and shelving), students in the division have also digitized hand-written field notes from several collectors and matched digitized records and field numbers to catalogued specimens, thus greatly enhancing the associated data and utility of those specimens. Finally, efforts to georeference records from Texas and Arizona, which were not completed during the previous HerpNet project, occupied the time of staff and students in 2018.
5. SCIENTIFIC PRODUCTS AUTHORED BY DIVISION PERSONNEL


6. SCIENTIFIC PRODUCTS BASED ON THE COLLECTION


7. SERVICE AND OUTREACH

- J.T. Giermakowski gave invited professional presentations on museum techniques (lecture to UNM class), careers in herpetology (Cibola High School), and current turtle research (New Mexico Turtle and Tortoise Club).
- Howard Snell served as a member of New Mexico Department of Game and Fish Species Recovery Team for Boreal Toads and Gila Monsters.
- Howard Snell served as an Elected Board Member, Tierra Grande Improvement Association (organization that administers 15,000 acres of protected areas in southern Manzano Mountains, Valencia County).
- J.T. Giermakowski served as a Member of New Mexico Department of Game & Fish Species Recovery Board.
- J.T. Giermakowski served as a member of the University of New Mexico Institutional Animal Care and Use Committee. 2016-2018.

8. AFFILIATED PERSONNEL

A. Faculty & Staff
H.L. Snell, Curator
W.H. Degenhardt, Curator Emeritus
Poe, S., Associate Professor and Associate Curator
J.T. Giermakowski, Senior Collection Manager
I.M. Latella, Research Scientist

B. Graduate students
Anderson, C., Ph.D. /Poe
Gray, L.N., Ph.D. /Poe
Latella, I.M., M.Sc./Poe
Loughran, C.L., Ph.D/Wolf

**C. Undergraduate Students**
Castillo, Shelby, Student employee.
Cruz, Paxton. Student employee.
Duran, Jonathan. Student employee
Griego, Tylee. Student employee.
Isom, Kaylee. Student employee.

**D. Research Associates**
Pierce, L.J.S., New Mexico Dept. of Game & Fish
Stuart, J.N., New Mexico Dept. of Game & Fish
Fitzgerald, L., Texas A&M University

Division of Amphibians and Reptiles on display at the MSB's annual open collections event.
1. DIVISION HIGHLIGHTS

MSB Arthropods continued with a number of exciting activities during 2018. Research activities included everything from the evolution of ant-mimicking spiders to using arthropods to study flooding regimes in the Rio Grande bosque, from grasshopper food habits to discovery of new species in beetles and moths. Teaching efforts supported by the collection ranged from foundational courses in Entomology to a novel course in Art and Biodiversity taught in cooperation between Biology and the MSBA and the UNM Department of Art in the College of Fine Arts. We continue to train and support both undergraduate and graduate students specific to the study of arthropods, but also many students across the department since arthropods factor into so many areas of biology. Collection growth for the past 10 years or so has been dramatic and the sheer number of specimens coming into our collection has outstripped our ability to formally accession them, so our focus has shifted somewhat to getting those specimens prepared and formally accessioned rather than field work to acquire large numbers of new specimens. To that end, we have focused on activities such as databasing previous projects such as those in White Sands, Bandelier, the Sevilleta and Cuatrociénegas as well as the excellent bee collection. We have also continued focus on getting identifications in several groups and inventorying special donated collections such as the Marc Rowland scarab collection and the Mark Romero tiger beetle collection. Even so, field work to acquire new specimens continues to be an important component of the MSBA’s activities this year including locally in the Southwest, such as at the Sevilleta and elsewhere, but also nationally, such as in the Southeast and the Pacific Northwest, and also internationally in Peru.

2. TABLE OF COLLECTION ACTIVITY

<table>
<thead>
<tr>
<th>Metric</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection Growth</td>
<td>5,353 specimens added</td>
</tr>
<tr>
<td>Loans: outgoing (no. of specimens)/incoming (no. specimens)</td>
<td>Outgoing 4 (186)</td>
</tr>
<tr>
<td>Specimen Records served via electronic databases</td>
<td>45,000 for all of SCAN</td>
</tr>
<tr>
<td>Publications using the collection</td>
<td>10</td>
</tr>
<tr>
<td>Citations of publications using the collection</td>
<td>10</td>
</tr>
</tbody>
</table>
3. EDUCATIONAL IMPACTS OF THE COLLECTION

Kelly Miller taught Entomology (BIOL485/585) to 12 students and Art and Biodiversity (BIOL419/ARTS429) to 15 students. Each of these courses emphasized arthropods heavily and used specimens from the collection extensively.

Karen Wright successfully defended her PhD dissertation and finish her graduate program in 2018 focusing on bee phyllogenetics and the evolution of diet breadth (specialization vs generalization).

Undergraduate Marlo McCarter finished work on arthropod samples from Valles Caldera National Preserve fire recovery study. To increase her experience with additional arthropod groups, she and Sandy worked on specimen backlog from the western US and from Nicaragua. Marlo also worked on specimen identifications. She will be starting grad school next fall with a broad background in arthropod taxonomy.

Matthew Leister has both used the collection and contributed to it from his Master’s work on spider phylogeny. He has made determinations on unidentified material for scorpions as well as spiders.

Ray Holland, a grad student of Tom Kennedy, is using ground-dwelling arthropods in part of his research on changes in the Rio Grande river channel through management efforts to bring about more flooding in the bosque. He is looking at changes in vegetation and arthropod diversity as a result of these treatments. He and Sandy have been working on identification methods and sources, as he tackles several disparate groups of arthropods.

Nick Homziak, former MSB Arthropods undergraduate student and museum assistant on the National Park Service, White Sands/Cuatrocienegas arthropod inventory project, and now graduate student at the University of Florida, prepared a manuscript describing a new species of moth in the genus Callistege (Lepidoptera, Erebidae), that he found during our collecting trips to Cuatrociénegas, Mexico. The type and paratype specimens are housed in the MSB. Eric Metzler, Dave Lightfoot, and Kelly Miller assisted with the manuscript and are co-authors. The manuscript was completed and submitted to the Journal of the Lepidopterist’s Society in 2018.

Dave Lightfoot served as mentor for UNM undergraduate student Marlo McCarter on her Research Experience for undergraduate students, research project; diet selection in desert grasshoppers, during the summer of 2018. This as part of the Sevilleta Long-Term Ecological Research Program (UNM; Sevilleta National Wildlife Refuge, NM), Research Experience for Undergraduate students. Activities included research project design, field and lab sampling design and implementation of protocols, microscopic preparation and analysis of hundreds of grasshopper guts and plant species reference slides. Marlo completed all field and lab work. She is writing her Senior Honors Thesis based on this research, and plans to submit her manuscript for publication in a peer-reviewed journal in 2019. Dave is coauthor.
Dave Lightfoot served as mentor for Highlands University (Las Vegas, NM) undergraduate student Anabella Miller, on a research project to inventory and to initiate long-term monitoring of grasshoppers, of the Rio Mora National Wildlife Refuge, NM, during the summer of 2018. Dave traveled to the Rio Mora NWR several times to teach and assist Anabella with the project. Anabella completed a report that she submitted to New Mexico Highlands University in 2018.

Dave Lightfoot served as mentor for UNM undergraduate (graduated May, 2018) student Wesley Noe, to analyze data for ground-dwelling arthropods, created from the Sevilleta LTER (Lightfoot and Brantley) during the 1990’s, and to write a manuscript on how annual variation in rainfall affects ground-arthropod communities across the Sevilleta NWR. Wesley completed data analyses, and Dave and Wesley are currently working on the manuscript. Voucher arthropod specimens are housed in the MSB. Wesley and Dave also worked on an arthropod reference collection for the Pueblo of Sandia, see below.

### 3a. COURSES USING THE COLLECTIONS

BIOL 406 Museum Studies, Natural History Collections, 18 students

### 3b. COURSES TAUGHT BY MSB PERSONNEL

<table>
<thead>
<tr>
<th>Instructor(s)</th>
<th>Semester</th>
<th>Course</th>
<th>Title</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brantley, Lightfoot</td>
<td>Spring</td>
<td>BIOL 406</td>
<td>Museum Studies</td>
<td>18</td>
</tr>
<tr>
<td>Miller, Kelly</td>
<td>Spring</td>
<td>BIOL485/585</td>
<td>Entomology</td>
<td>12</td>
</tr>
<tr>
<td>Miller, Kelly</td>
<td>Fall</td>
<td>BIOL419/519</td>
<td>Art and Biodiversity</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ARTS429/529</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 4. COLLECTION MANAGEMENT

Sandy completed the return of all outstanding alcohol specimens on loan to Mark Rowland. Sandy and undergraduate assistant Marlo McCarter prepared, labeled, and databased 600+ specimens donated by Mark Romero over the last 10 years. In SCAN there are now 731 specimens from Mark, 160 of which are tiger beetles, which are his specialty. Mark’s specimens are mostly from NM and other southwestern states. He also contributed specimens to the teaching collection, which Catherine Cumberland is upgrading.
Rick Buss identified many beetle specimens from the Main Collection, and from the Sevilleta National Wildlife Refuge, Grand Canyon National Park, and Sandia National Laboratories collections that are housed in the MSB. Jens Esser, a German specialist on the Cryptophagidae visited the collection and borrowed some specimens. Three papers came out on the family (see publications section below).

Matthew Leister and Sandy worked with an archeological consulting firm that was working on the excavation of a burned pit house. Attached to one of the wooden beams was a mud-dauber wasp’s nest, with several charred spiders inside. Matthew made images of the spiders, which could be identified to family; they were perfectly preserved but extremely fragile. A few of the spiders were used for carbon dating, corroborating dates from the pit house itself. The structure was burned around 800AD. The archeologists will be presenting a talk in spring 2019 about the excavation, including the unusual finding of the wasp nest. Matthew and Sandy used specimens from the collection to introduce the archeologists to the spider families they found.

Mark Ward, entomologist on the Valles Caldera project, finished up samples and identifications in August and returned to Maine. He left many identified specimens and database records for the Museum collection. Sandy received more money from the project to identify and count spiders from the Valles Caldera Thompson Ridge fire samples.

Catherine Cumberland (graduate museum assistant) and Dave Lightfoot continued with the organization and databasing of the Main Collection bee collection for SCAN. Graduate students Karen Wright and Julieta Bettinelli assisted with taxonomic identifications.

Marlo McCarter (undergraduate museum assistant) and Dave Lightfoot worked on incorporating identified, labeled and databased (SCAN) specimens from the Grand Canyon and White Sands/Cuatrociengas, National Park Service inventory projects collections, into the dry specimen Main Collection.

Dave Lightfoot worked with personnel from the Sevilleta Long-Term Ecological Research program (Biology Dept., Dr.s Jennifer Rudgers and Ken Whitney, LTER staff Jade McLaughlin, graduate student Melanie Kazenel) to initiate the development of extensive reference and voucher specimen collections for the bees of the Sevilleta NWR. The reference bee collection is a special research collection within the Division of Arthropods. Dave provided training on specimen curation and collection classification/organization. The bee reference collection is being constructed from bee specimens collected in long-term monitoring bee traps in 2017 and 2018, and will continue for years to come. The Sevilleta bee trap monitoring study was initiated by graduate student Karen Wright, and is being continued by the Sevilleta LTER program. Specimens will be added over the years until all taxa are well represented. This is a working collection for students and other researchers to use for the identification of regional native bees. This reference/voucher bee collection will reduce the use and possible damage of bee specimens from the Sevilleta that are housed in the Main Collection.
Dave Lightfoot and Marlo McCarter enhanced the MSB, Sevilleta grasshopper reference collection, including the addition of several hundred new specimens that were collected by them during the summer of 2018, for Marlo’s research project (see above). Several hundred leg tissue samples for DNA of all of the taxa were prepared and stored in the lab freezer. An array of morphometric measurements were taken from all grasshopper specimens in the Sevilleta grasshopper reference collection by museum assistant Alison Verhaagen. The morphometric data will be used to characterize morphological evolutionary traits of Sevilleta grasshopper species.

Dave Lightfoot and Sandra Brantley completed sorting and tabulating hundreds of arthropod pitfall trap samples from Bandelier National Monument for a long-term research project monitoring ground arthropod communities across and elevation gradient in the Jemez Mountains, relative to climate change. That study has been funded by the USGS and the NPS. The study has been ongoing since 1992. Dave set aside thousands of specimens of arthropods across all taxonomic group, to be curated and added to the Main Collection. That process will be accomplished over coming years, and will provide the MSB with a very thorough collection of arthropod taxa from the Jemez Mountains, along with other specimens and taxa obtained from Robert Parmenter’s arthropod research at the Valles Caldera National Monument. The MSB houses special arthropod research collections for both Bandelier National Monument and for the Valles Caldera National Monument.

Dave Lightfoot obtained a contract from Sandia National Laboratories to identify insects from long-term monitoring sticky traps (flying insects) and pitfall traps (ground-dwelling arthropods) from locations across Kirtland Air Force Base. Dave obtained hundreds of arthropod specimens for the MSB collection. Sandra Brantley and Rick Buss helped to identify specimens.

Dave Lightfoot and Wesley Noe provided arthropod identification services for several hundred arthropod specimens collected from reptile pitfall traps by the Pueblo of Sandia. Dave is building a special research collection of arthropods of the Pueblo of Sandia, and the MSB is housing the collection.

Dave Lightfoot made several collecting trips across the Southwest and the Pacific Northwest to obtain specimens and DNA tissue samples of Oedipodinae grasshoppers as part of his taxonomic research. Specimens and tissue samples are housed in the MSB.

Kelly Miller made collecting trips to Florida and Peru for general collecting and to collect water beetles for specific research projects. Specimens are housed in the MSB.
5. SCIENTIFIC PRODUCTS AUTHORED BY DIVISION PERSONNEL


6. SCIENTIFIC PRODUCTS BASED ON THE COLLECTION


### 7. SERVICE AND OUTREACH

- **Brantley, S.L.** Lecture and field day with the Master Naturalists Program (Bernalillo County Open Space), 20 students, July.
- **Brantley, S.L.** Strength in Numbers: how spiders and insects make a living. Presentation and display table at the EPSCoR Science fiesta for STEM fields, May.
- **Brantley, S.L.** and **R. Alfaro.** Guests on KUNM’s Children’s Hour for Q and A program on spiders, September.
- **Brantley, S.L.** and **C. Cumberland.** Presentation to the UNM Staff Council on the roles of academic staff in the Biology Dept., March, 20 people.
- **Tours:** 28 students from East Mountains HS, presentation on professions involving animals, May.
- **Dave Lightfoot;** served as solicited peer reviewer for submitted articles to the journals: Journal of Orthoptera Research, Insect Systematics and Evolution, ZooTaxa, Western North American Naturalist, US Forest Service, Rocky Mountain Research Station.
- **Dave Lightfoot;** served as a member of the International Union for Conservation of Nature (IUCN) Grasshopper Specialist Group, to provide conservation evaluations and conservation strategy recommendations for North American grasshopper, cricket and katydid species for the IUCN.

### 8. AFFILIATED PERSONNEL

**A. Faculty & Staff**

Kelly Miller, Curator, Professor  
Sandra Brantley, Senior Collection Manager, Research Assoc. Professor  
David Lightfoot, Senior Collection Manager, Research Assoc. Professor  
Mark Ward, UNM/Valles Caldera National Preserve Research Scientist
B. Graduate students

Matthew Leister, Master’s student
Catherine Cumberland, Ph.D. candidate
Julieta Bettinelli, PhD candidate
Karen Wright, PhD candidate (finished in 2018)

C. Undergraduate Students

Marlo McCarter
Wesley Noe
Allison Verhaagen
Mae Ling Kao

D. Research Associates

Robert Parmenter, Valles Caldera National Preserve
Eric Metzler, Alamogordo, NM
Ernest Valdez, NM Landscapes Field Station

E. Community volunteers

Sharyn Davidson
Richard Buss

PRESENTATIONS/POSTERS

• Brantley, S.L.* 2018. MSB Division of Arthropods, Collection Managers’ presentations to Dr. Mark Peceny, Dean of UNM’s College of Arts and Sciences, August.
MSB Division of Birds
2018 Annual Report

1. DIVISION HIGHLIGHTS

2018 was another busy and productive year for the MSB Division of Birds. Ten of our Division-affiliated personnel attended the American Ornithological Society meeting in Tucson and presented on their research. We conducted fieldwork in many parts of the world this year, starting in February with an expedition to the Andes of north-central Peru. We conducted fieldwork in southern and central New Mexico at various times during spring and summer, including a successful effort to recover geolocators (micro-tracking devices) from Gray Vireos at the Sevilleta National Wildlife Refuge. We also collected the first tissues of Bell's Vireos from New Mexico, a species of regional conservation concern. In early summer, we undertook a major expedition to the Solomon Islands as part of Associate Curator, Michael Andersen's NSF-funded field research program. During July, we undertook a student led expedition to Peru to study the migratory behavior and ecology of the Giant Hummingbird. At the end of the fall, we conducted an expedition to Chile, where we collected the first modern museum specimens of birds in existence from that country. We hosted field researchers from the Moore Laboratory at Occidental College and from Harvard University from two separate collecting efforts: we brought Dr. Ryan Terrill and collaborators from the Moore Lab to Mesa Chivato to study molt-migration of Chipping Sparrows, whereas we brought Dr. Kathrin Naepflin and her collaborators from Harvard University all around Albuquerque to collect House Finches for a study of Mycoplasma pathogens. We collected samples of woodpecker brains for collaborators on North Campus so they could study the birds’ resistance to CTE. In July, we participated in survey of nesting Brown-capped Rosy Finches at Vermejo Park coordinated by the New Mexico Ornithological Society. We hosted an evening class for the Master Naturalists in the collection so that they could see birds up close. We also helped the Maxwell Museum identify feathers in their artifacts. We conducted a major import of specimens from Australia, including many specimens that were collected by graduate student, Serina Brady, during her internship at the Australia National Wildlife Collection, along with additional specimens that were donated by the Australia National Wildlife Collection and that represent the diversity of the Australian avifauna. We taught two UNM courses: Avian Scientific Specimen Preparation (taught annually) and the Natural History Museum Curation class. Finally, we published two major papers based on the collection that comprised successful student thesis projects carried out in the Division of Birds. One of those publications was by Libby Beckman, now a postdoc at Berkeley (Beckman et al. 2018, below) that was featured with a special invited commentary in the journal Molecular Ecology. The other was by Chauncey Gadek, now a Ph.D. student in our division, in Journal of Animal Ecology (see Gadek et al. 2018, below). Finally, Xena Mapel, Division affiliated
undergraduate, was awarded Outstanding Undergraduate by the UNM Biology Department. She started as a M.S. student in the fall after graduating with her B. S.

2. TABLE OF COLLECTION ACTIVITY

<table>
<thead>
<tr>
<th>Metric</th>
<th>Number</th>
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<tbody>
<tr>
<td>Collection Growth</td>
<td>968</td>
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<tr>
<td>Loans (outgoing (no. of specimens)/incoming (no. of specimens)</td>
<td>Outgoing: 26 (881)</td>
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<tr>
<td>Specimen Records served via electronic databases</td>
<td>12,271 queries, finding 4,880,124 records</td>
</tr>
<tr>
<td>Publications using the collection</td>
<td>28</td>
</tr>
<tr>
<td>Citations of publications using the collection</td>
<td>610</td>
</tr>
</tbody>
</table>

3. EDUCATIONAL IMPACTS OF THE COLLECTION

In addition to its traditional role as a center for the study of birds by students of birds at all levels, this collection is used for approximately one tour per month on average and reaches all demographics of the community from second graders to retirees. It is also used by artists.

3a. COURSES USING THE COLLECTIONS

- BIOL 386L, General Vertebrate Zoology, spring and fall semesters, 53 students
- BIOL 499, Avian Scientific Specimen Prep, Spring, 9 students
- BIOL 191, Biodiversity, Spring, 22 students
- BIOL 303, Ecology and Evolution; core curriculum Sandhill Crane bone lab.

Crowded Bird Range for the MSB’s annual open-collections event. Graduate student Jessie Williamson (left, foreground) explains her hummingbird migration research to visitors, while Research Associate Matthew Baumann (center, background) explains Peruvian tanager diversity.
3b. COURSES TAUGHT BY MSB PERSONNEL

<table>
<thead>
<tr>
<th>Instructor(s)</th>
<th>Semester</th>
<th>Course</th>
<th>Title</th>
<th>Enrollment</th>
</tr>
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<tbody>
<tr>
<td>Witt</td>
<td>Fall</td>
<td>BIOL 519</td>
<td>T: Ornithological Field Expedition</td>
<td>1</td>
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<tr>
<td>Witt</td>
<td>Fall</td>
<td>BIOL 551</td>
<td>Research Problems</td>
<td>1</td>
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<tr>
<td>Witt</td>
<td>Fall</td>
<td>BIOL 599</td>
<td>Master's Thesis</td>
<td>1</td>
</tr>
<tr>
<td>Witt</td>
<td>Fall</td>
<td>BIOL 499</td>
<td>Undergraduate Problems</td>
<td>2</td>
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<tr>
<td>Witt</td>
<td>Fall</td>
<td>BIOL 502</td>
<td>T: Molecular Systematics Discussion</td>
<td>2</td>
</tr>
<tr>
<td>Witt</td>
<td>Fall</td>
<td>BIOL 551</td>
<td>Research Problems</td>
<td>2</td>
</tr>
<tr>
<td>Witt</td>
<td>Fall</td>
<td>BIOL 502</td>
<td>T: Brown Bag Research Seminar</td>
<td>4</td>
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<tr>
<td>Witt</td>
<td>Fall</td>
<td>BIOL 519</td>
<td>T: High Altitude Biology</td>
<td>7</td>
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<tr>
<td>Witt</td>
<td>Fall</td>
<td>BIOL 402</td>
<td>T: Brown Bag Research Seminar</td>
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<tr>
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<td>BIOL 502</td>
<td>T: Molecular Systematic Discussion</td>
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<tr>
<td>Witt</td>
<td>Spring</td>
<td>BIOL 599</td>
<td>Master's Thesis</td>
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<td>Witt</td>
<td>Spring</td>
<td>BIOL 502</td>
<td>T: Brown Bag Research Seminar</td>
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<tr>
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<td>Spring</td>
<td>BIOL 551</td>
<td>Research Problems</td>
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<tr>
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<td>Spring</td>
<td>BIOL 402</td>
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<td>Johnson/Witt</td>
<td>Spring</td>
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<td>T: Avian Sci Specimen Prep</td>
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<tr>
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<td>BIOL 519</td>
<td>T: Natl Hist Museum Curation</td>
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<tr>
<td>Johnson/Witt</td>
<td>Spring</td>
<td>BIOL 402</td>
<td>T: Avian Sci Specimen Prep</td>
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<tr>
<td>Witt</td>
<td>Spring</td>
<td>BIOL 402</td>
<td>T: Brown Bag Research Seminar</td>
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<td>BIOL519</td>
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<tr>
<td>Witt</td>
<td>Summer</td>
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<td>Undergraduate Problems</td>
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<tr>
<td>Witt</td>
<td>Summer</td>
<td>BIOL 599</td>
<td>Masters Thesis</td>
<td>1</td>
</tr>
</tbody>
</table>

4. COLLECTION MANAGEMENT

The collection contained over 46,500 catalogued bird specimens at the end of 2018. These are heavily comprised of recently collected materials, as evidenced from our active expeditionary fieldwork program (see highlights, above). These specimens are catalogued and managed in the Arctos database, from which their data is served to the public.

5. SCIENTIFIC PRODUCTS AUTHORED BY DIVISION PERSONNEL

1. Gadek, Chauncey R; Newsome, Seth D; Beckman, Elizabeth J; Chavez, Andrea N; Galen, Spencer C; Bautista, Emil; Witt, Christopher C; 2018. Why are tropical mountain passes “low” for some species? Genetic and stable-isotope tests for differentiation, migration and expansion in elevational generalist songbirds. *Journal of Animal Ecology* 87: 741-753
2. Johnson, A. B. 2018. Results of an Elf Owl (Micrathene whitneyi) survey in Dark Canyon, Guadalupe Mountains, Eddy County, New Mexico. NMOS Bulletin 45:

3. Per Alström, Alice Cibois, Martin Irestedt, Dario Zuccon, Magnus Gelang, Jon Fjeldså, Michael J Andersen, Robert G Moyle, Eric Pasquet, Urban Olsson; 2018. Comprehensive molecular phylogeny of the grassbirds and allies (Locustellidae) reveals extensive non-monophyly of traditional genera, and a proposal for a new classification. Molecular Phylogenetics and Evolution:


5. Perez-Eman, Jorge L; Ferreira, JHONIEL PERDIGÓN; Gutierrez-Pinto, Natalia; Cuervo, Andres M; Cespedes, Laura N; Witt, Christopher C; Cadena, CARLOS DANIEL; 2018. An extinct hummingbird species that never was: a cautionary tale about sampling issues in molecular phylogenetics. Zootaxa 4442: 491-497


8. Trujillo-Arias, Natalia; Calderón, Luciano; Santos, Fabricio R; Miyaki, Cristina Y; Aleixo, Alexandre; Witt, Christopher C; Tubaro, Pablo L; Cabanne, Gustavo S; 2018. Forest corridors between the central Andes and the southern Atlantic Forest enabled dispersal and peripatric diversification without niche divergence in a passerine. Molecular phylogenetics and evolution 128: 221-232

9. Smith, Brian Tilston; Mauck, William M; Benz, Brett; Andersen, Michael J; 2018. Uneven missing data skews phylogenomic relationships within the lories and lorikeets. bioRxiv : 398297

10. O’Connor, Ryan S; Smit, Ben; Talbot, William A; Gerson, Alexander R; Brigham, R Mark; Wolf, Blair O; McKeechnie, Andrew E; 2018. Avian thermoregulation in the heat: is evaporative cooling more economical in nocturnal birds?. Journal of Experimental Biology 221: jeb181420


6. SCIENTIFIC PRODUCTS BASED ON THE COLLECTION


### 7. SERVICE AND OUTREACH

We conducted 12 division tours in 2018. We initiated a collaboration with North Campus UNM researchers on Woodpecker Tauopathy. We hosted the president of Western Field Ornithologists to plan the 2019 conference in Albuquerque. We volunteered our services to University of Toledo researchers who were working on Gray Vireos at Sevilleta NWR. We volunteered our services further to researchers from MLZ (Occidental College) and MCZ.
(Harvard Univ.) (see highlights, above). We hosted woodcarver Robert Newman to study Burrowing owl specimens. We hosted various UNM anthropologists and zooarchaeologists to identify bird remains. We helped to initiate a bone isotope project with Miranda LaZar, grad student in UNM Dept. of Anthropology. We hosted a Master Naturalist class on bird identification. Finally, we participated in the MSB Open Collections event, 2018, in conjunction with the UNM Biology Research Days events.

8. AFFILIATED PERSONNEL

A. Faculty & Staff
   Andrew Johnson, Senior Collection Manager
   Christopher Witt, Curator
   Michael Andersen, Associate Curator
   Blair Wolf, Associate Curator

B. Graduate students
   Jessie Williamson
   Chauncey Gadek
   Peter Mattison
   Marialejandra Farias Castro
   Oona Takano
   Jenna McCullough
   Serina Brady
   Xena Mapel
   Ethan Gyllenhaal
   Kristen Oliver

An innovative display using specimens arrayed on a map to depict evolutionary diversification across archipelagoes, and the research and collecting program of Asst. Prof. and Curator, Dr. Mike Andersen, in the Solomon Islands. From MSB's annual open-collections event.
Graphical abstract from Gadek et al. 2018, *J. Animal Ecol.*, and study that was entirely based on MSB bird specimens. Janzen’s Rule predicts restricted elevational ranges for tropical montane species. On the west slope of the Peruvian Andes, a handful of songbird species defy this prediction, and MSB has outstanding and extensive collections of these species. Gadek et al. made tests for recent population expansion, elevational movement, and genetic divergence that revealed that elevational generalism has been unstable and fleeting. These exceptions prove Janzen’s Rule. (Photo credits: Tom Kennedy, *Troglodytes aedon*; Dario Sanches, *Zonotrichia capensis.*)
1. DIVISION HIGHLIGHTS

Currently, the MSB Division of Fishes has 102,028 cataloged lots of fishes (4,074,404 specimens). During the year, 585 lots of fishes (7,217 specimens) were cataloged and integrated into the main collections. There are 91,226 digital files of field notes and 650 jpg files of habitat photographs and specimens (for color). There are 42,743 specimen (georeferenced) locality records. The Curator of Fishes, Thomas Turner, took leave of absence from UNM to August 2018, and served as a rotating Program Officer in the Division of Environmental Biology at the National Science Foundation. Curator-emeritus Steve Ross served as Acting Curator during Dr. Turner’s absence. MSB Senior Collections Manager, Alexandra Snyder, retired in September 2018 after 26 years of service to the Division, the Museum, and the University, and the international collections community. She was hired at UNM in 1993 and was Collection Manager at the Burke Museum of Natural History in Seattle, Washington. Before that, she was a curatorial staff member at the University of Michigan Museum of Zoology and supported and archived some of the most important ichthyological work ever conducted in freshwaters of the United States. We are in the process of filling this vacant position. A new Ph.D. graduate student arrived in Fall 2018, Katelyn Driscoll (University of Montana, Missoula) who completed a MS degree in stream ecosystem ecology. Guests hosted in 2018: Jonathan Dombrosky, University of New Mexico Anthropology Department; Stephen Zipper, SWCA Environmental Consultants, Albuquerque, NM; Tracy A. Diver, US Fish and Wildlife Service and Southwestern Native Aquatic Resources and Recovery Center, Dexter NM; Pauletta Dodge, SWCA Environmental Consultants, Albuquerque, NM; Gabriela Wolf-Gonzalez, University of Kentucky, Lexington.
2. TABLE OF COLLECTION ACTIVITY

<table>
<thead>
<tr>
<th>Metric</th>
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<tbody>
<tr>
<td>Collection Growth (specimens)</td>
<td>7,217</td>
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<td>5 (1327)/3(935)</td>
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<td>Citations of publications using the collection</td>
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3. EDUCATIONAL IMPACTS OF THE COLLECTION

3A. COURSES USING THE COLLECTION

<table>
<thead>
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<th>Instructor</th>
<th>Semester</th>
<th>Course</th>
<th>Title</th>
<th>Enrollment</th>
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<tr>
<td>Turner</td>
<td>Fall</td>
<td>BIOL 386L U 001</td>
<td>General Vertebrate Zoology</td>
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<td>Turner</td>
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<td>BIOL 386L U 002</td>
<td>General Vertebrate Zoology</td>
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<tr>
<td>Turner</td>
<td>Fall</td>
<td>BIOL 551 M 033</td>
<td>Research Problems</td>
<td>1</td>
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<td>Turner</td>
<td>Spring</td>
<td>BIOL 551 M 032</td>
<td>Research Problems</td>
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3B. COURSES TAUGHT BY MSB PERSONNEL

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<th>Instructor</th>
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<td>BIOL 551 M 033</td>
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<td>Spring</td>
<td>BIOL 551 M 032</td>
<td>Research Problems</td>
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</tbody>
</table>

4. COLLECTION MANAGEMENT

MSB fish and data records are available from the following data portals: ARCTOS, Global Biodiversity Information Facility (GBIF), FishNet2 network, and iDigBio.

Collections were received from the following sources and projects: Wyoming Dept. Game and Fish, Laramie WY, USGS Grand Canyon Monitoring Center, Flagstaff AZ, Southwest Native Aquatic Resources and Research Center, Dexter NM, USFWS NM/TX Fish and Wildlife
Conservation Office, Albuquerque NM, US Bureau of Reclamation (Salt Lake City and Albuquerque), U.S. Bureau of Land Management (Taos and Las Cruces), BioPark Aquatic Conservation Facility, Albuquerque NM, American Southwest Ichthyological Researchers, and New Mexico Dept. Game and Fish.

Ongoing sponsored research projects generated by Turner Aquatic Conservation Laboratory were supported, in part, by MSB collection management: Rio Grande Silvery Minnow (Hybognathus amarus) Genetic Monitoring, Bonytail Chub (Gila elegans) Reproductive Ecology and Genetics, Gila Trout (Oncorhynchus gilae) Genetics, Fire response of Gila River Native Fishes, and Canadian River Native Fishes genetic and demographic monitoring projects.

Grand Canyon National Park Colorado River larval fish surveys generated about 150 lots (20 dram vial jars) and 44,418 age-0 specimens during 2018. Larval Catostomids (maintained in 95% EtOH) from this project are being genotyped under a two-year U.S. Bureau of Reclamation project (Principal Investigators: Thomas F. Turner, University of New Mexico, Thomas E. Dowling, Wayne State University, and Trevor J. Krabbenhoft, University of Buffalo).

San Juan River larval fish collections in 2018 yielded 41,064 age-0 specimens (maintained in 95% EtOH) including 54 Colorado Pikeminnow and 1,833 Razorback Sucker. Specimens continue to show a high rate of opercular deformities (15.3%) as first reported by Barkstedt et al. in 2018 (see publications). The MSB continues to receive funding to catalogue and maintain fish collected in the Grand Canyon and San Juan River and these long-term collections form the foundation of current long-term assessments of endangered fish populations.

MSB Research Associate, Tracy Diver (UNM, M.S. 2015) and current Fish Biologist at the USFWS’s Southwestern Native Aquatic Resource and Recovery Center in Dexter, NM, initiated a project using MSB larval fish to determine effective number of breeding ($N_b$) Colorado Pikeminnow and Razorback Sucker in the San Juan River. In 2018, she spent almost one-month at MSB taking tissue samples from 2016–2018 larval Colorado Pikeminnow ($n=173$), Razorback Sucker ($n=382$), and Flannelmouth Sucker (2013–2018; $n=786$). Selected specimens were dissected and heads retained so that otoliths could be examined and aged (in days).

Another MSB Division of Fishes based project conducted in 2018 concerned age and growth of larval San Juan River Colorado Pikeminnow and Razorback Sucker. Otoliths were extracted from ca. 500 larval Colorado Pikeminnow and 500 larval Razorback Sucker collected from 2009 to 2017 (and stored in 95% EtOH). Daily growth was determined (in days), and spawning dates were back calculated and modeled using a variety of variables (year, discharge, water temperature). In addition, four different growth functions were generated using multiple models (von Bertalanffy, Gompertz, logistic, and polynomial). The 400+ different MSB catalogued lots used in this project are noted in the manuscript slated for submission in mid-2019.

A five-year cooperative, interdisciplinary research project between the University of New Mexico and Colorado State University was funded (by the U.S. Bureau of Reclamation)
beginning in 2018. The scope of the work is to investigate relationships between changing habitat conditions in the Middle Rio Grande and the population dynamics of Rio Grande Silvery Minnow by integrating data sets and knowledge among the disciplines of hydrology, geomorphology, and biology. The CSU team, from their Department of Civil Engineering, provides expertise in the field of sediment transport and river mechanics. The CSU team developed state-of-the-art computer models in hydrology and hydraulics for the simulation of water, sediment, and contaminant transport at the watershed level. The UNM team provided expertise on the life history, habitat use, ecology, and genetics of Rio Grande Silvery Minnow. This collaborative analysis of almost 20 years of fish data will rely on information generated from over 40 Rio Grande Silvery Minnow projects (with all project material housed at MSB for reference and verification). In 2018, the first biological synthesis of Rio Grande Silvery Minnow was drafted (using the aforementioned projects). The final version of the report was accepted in early 2019 and will appear in the 2019 MSB annual report.

In 2018, a long-term cooperative project (cyprinid fish larvae and early juveniles of the middle and lower Pecos River and Rio Grande) between the MSB Division of Fishes and Colorado State University Larval Fish Laboratory was completed. This 222-page tome provides 16 early life history description of fishes from the study area. Detailed keys establish meristic values, morphometric measures, developmental rates, and pigmentation characters from protolarvae to early juvenile ontogenetic stages. Accompanying those data are original detailed scientific illustrations depicting dorsal, lateral, and ventral views of specimens throughout larval development. All of the larval used in this study (including the developmental series reared at Southwestern Native Aquatic Resource and Recovery Center in Dexter, NM, are catalogued in the Division of Fishes and referenced throughout this work. This work is a companion volume to a similar effort being prepared for the fishes of the Middle Rio Grande, NM by CSU and MSB Fishes personnel.

In 2018, MSB Division of Fishes personnel worked with Gabriela A. Wolf-Gonzalez, a graduate student at the University of Kentucky Department of Forestry and Natural Resources who is studying the diet of a reintroduced river otter population in New Mexico (advisor, Dr. John J. Cox). Ms. Wolf-Gonzalez used specimens in the Division of Fishes to create an identification guide to fish scales so that the river otter prey items (remaining in their scat) could be identified for their study. Division of Fishes specimens (potential fish prey) from the range of reintroduced river otter were examined and scales and pharyngeal teeth removed from selected MSB material (see MSB visitors).
5. SCIENTIFIC PRODUCTS AUTHORED BY DIVISION PERSONNEL

5b. JOURNAL ARTICLES


5c. TECHNICAL REPORTS


5D. AWARDS, GRANTS, AND CONTRACTS (PI in bold)

- **Hamilton, G.L.** A novel approach to trace effects of invasive species across food webs using stable isotopes. American Society of Ichthyologists and Herpetologists, McCarley Award. $1,000
- **Hamilton, G.L.** A novel approach to trace effects of invasive species across food webs using stable isotopes. UNM Center for Stable Isotopes Pilot Grant. $500.
- **Hamilton, G.L.** A novel approach to trace effects of invasive species across food webs using stable isotopes. UNM GPSA New Mexico Research Grant. $5,000.
- **Osborne, M. J.** Genetic status assessment of Chihuahua Chub. New Mexico Department of Game and Fish. 14 Dec 2018 to 31 Dec 2019: $12,704.
- **Turner, T. F.** Linking morpho-dynamic and biological-habitat conditions on the Middle Rio Grande. Colorado State University. 22 September 2017 to 21 September 2018. $90,000.
- **Turner, T. F.** and M. J. Osborne. Range-wide genetic assessment of loach minnow and spikedace Bureau of Reclamation 30 August 2018 to 30 September 2021. $138,525.00
- **Turner, T. F.** Curation of Lower Colorado River Basin Larval Fish Collections and Digital Files Bureau of Reclamation 16 April 2018 to 30 September 2022. $293,883.

5E. Other

6. SCIENTIFIC PRODUCTS BASED ON THE COLLECTION

6b. JOURNAL ARTICLES BASED ON THE COLLECTION


6c. TECHNICAL REPORTS BASED ON THE COLLECTION


6d. OTHER PRODUCTS BASED ON THE COLLECTION

7. SERVICE AND OUTREACH

7a. CONTRIBUTED TALKS/POSTERS AT PROFESSIONAL MEETINGS (presenter’s name in bold)


### 7B. Attendance at Professional Meetings

• **A. C. Cameron**

• **D. T. Camak**

• **G. L. Hamilton**
  o 7th Natural History of the Gila Symposium, Silver City, NM. February 2018.
• **K. P. Driscoll**  

• **S. T. Ross**  

• **T. F. Turner**  

• **W. H. Brandenburg**  
  o Colorado River Aquatic Biologists. Laughlin, NV. January 2018.  

### 7C. Service as Editor or on Editorial Board of a Journal

• **S. T. Ross**  
  o Co-editor, Volumes 2 and 3, North American Freshwater Fishes, Johns Hopkins University Press.

• **T. F. Turner**  
  o Editorial Board, Ecology of Freshwater Fish

### 7D. Service as Officer of Professional Society/Organization

• **G.L. Hamilton**  
  o Chair (Elections Committee), UNM Graduate & Professional Student Association  
  o Member (Grants Committee), UNM Graduate & Professional Student Association  
  o Co-Chair (Social Committee), UNM Biology Graduate Student Association  
  o Member, 8th Natural History of the Gila Symposium Planning Committee

• **M. J. Osborne**  
  o Member, Rio Grande Silvery Minnow Propagation and Genetics Workgroup  
  o Alternate Member, Gila Trout Recovery Team  
  o Alternate Member, Executive Committee Middle Rio Grande Collaborative Program  
  o Scientific Member, University of New Mexico IACUC Committee

• **S. T. Ross**  
  o Chair, Robert K. Johnson Award for Excellence in Service Committee, American Society of Ichthyologists and Herpetologists.

• **T. F. Turner**  
  o Program Director, DEB Pop & Community Ecology, National Science Foundation  
  o Program Director, Coupled Human & Natural Systems, National Science Foundation  
  o Independent Science Advisory Board Member, Northwest Power Council  
  o Executive Committee, Middle Rio Grande ESA Collaborative Workgroup  
  o Member, Gila Trout and Chihuahua Chub Recovery Team  
  o Organizer, American Fisheries Society Genetics Symposium
7E. Service (Other)

- **M. J. Osborne**
  - Bosque School, Albuquerque, NM, mentor for research project.
  - Zia Elementary School, science fair judge.

7F. Other Professional Activities

- **K. P. Driscoll**
  - Presentation to First Friday All Climate Change Talks (FFACTS) hosted by Forest Service Research & Development and the USDA Climate Hubs. *After Fire: Toolkit for the Southwest*. 2 March 2018.

- **M. J. Osborne**
  - Journal Referee, Molecular Ecology
  - Journal Referee, North American Journal of Aquaculture
  - Journal Referee, Genetica

- **R. K. Dudley**
  - Journal Referee, North American Journal of Fisheries Management

- **T. F. Turner**
  - Journal Referee, Transactions Am Fish Soc (2)
  - Journal Referee, Estuaries and Coasts
  - Journal Referee, Freshwater Biology
  - Proposal Review, National Science Foundation (211)

8. Affiliated Personnel

8A. Faculty and Staff

Thomas F. Turner, Curator of Fishes, Professor of Biology, and Assoc. Dean for Research
Steven P. Platania, Associate Curator of Fishes
Stephen T. Ross, 2017-2018 Acting Curator of Fishes, Museum of Southwestern Biology, Curator Emeritus, and UNM Adjunct Professor of Biology
Megan J. Osborne, Research Assistant Professor, MSB Research Associate
Alexandra M. Snyder, Former Collections Manager (retired September 2018)
Scott R. Clark, Former Postdoctoral Research Fellow (left UNM November 2018) and current U.S. Fish and Wildlife employee (Baton Rouge, LA)
8b. **Graduate Students**

**Museum Research Assistants-Graduate Student TA**

Alexander C. Cameron Fall 2018

**MSB Fishes Graduate Students, UNM Biology**

David T. Camak, Ph.D. Candidate
Alexander C. Cameron, Ph.D. Student
Gregor L. Hamilton, Ph.D. Student
Katelyn Driscoll, Ph.D. Student

8c. **Undergraduate Students**

Brian Fitzgerald, A&S Biochemistry
Charisa Bell, A&S Biology

8d. **Research Associates**

**Curatorial Associates**

David L. Propst, Curatorial Associate and UNM Adjunct Professor of Biology

**Research Associates**

Adam L. Barkalow, M.S., American Southwest Ichthyological Researchers, Albuquerque
Stephani L. Clark-Barkalow, M.S., American Southwest Ichthyological Researchers, Albuquerque
W. Howard Brandenburg, American Southwest Ichthyological Researchers, Albuquerque
James E. Brooks, US Fish and Wildlife Service, Albuquerque (retired)
Brooks M. Burr, Ph.D. Southern Illinois University, Carbondale
Robert K. Dudley, Ph.D., American Southwest Ichthyological Researchers, Albuquerque
Michael A. Farrington, M.S., American Southwest Ichthyological Researchers, Albuquerque
Eliza I. Gilbert, M.S., USFWS Ecological Services, Albuquerque
Jennifer L. Kennedy, American Southwest Ichthyological Researchers, Albuquerque
Martinique J. Chavez, American Southwest Ichthyological Researchers, Albuquerque
Tracy Diver, M.S., Southwestern Native Aquatic Resources and Recovery Center, Dexter
1. DIVISION HIGHLIGHTS

In 2018, the Division of Genomic Resources finalized the transition to a fully functional, vapor-phase, nitrogen storage system during the third year of funding from the National Science Foundation Collections in Support of Biological Research (CSBR-1561342). The focus for this year was to complete an inventory of samples moved to nitrogen storage from ultralow mechanical freezers, and to finalize the tracking of newly-migrated samples from the DGR Locator database to Arctos Object Tracking. Teresa Mayfield was hired with grant funds as project manager to oversee the inventory and object tracking of samples moved into storage in cryotanks. With Teresa’s help, >140,000 samples were moved into vapor-phase nitrogen, and another 70,000 samples will be moved in 2019, during the planned one-year grant extension.

The division issued 53 loans of 2,168 specimens in 2018. The DGR collection grew by 74,502 new samples, a 15% growth rate. The total number of cryovials in the collection is over 500,000.

Major projects archived in DGR in 2018 include NEON, BLM Malpais birds, BLM Malpais mammal tissues and parasites, Pecos mammal tissues and parasites, Philmont Scout Ranch mammal tissues, Solomon Islands birds, and Mexican wolf blood and serum samples.

In addition, a new MOU was signed with the Albuquerque Biopark and approximately 3,000 zoo tissues were officially accessioned into MSB collections. Barcoding of this collection is ongoing through the efforts of student and community volunteers.

The Division also obtained $5,500 in funding from the Alaska Department of Fish and Game in 2018 to cover curatorial costs for archiving ADFG marten tissues and parasites from Central Alaska. These funds have been placed in a new Non-Student Accounts Receivable index for the museum. This fund is also now being used to recover costs for external loans ($100 in 2018) based on a new policy in the Divisions of Mammals and Birds.

In order to recover costs associated with cryogenerator service and maintenance, the Division now sells liquid nitrogen to other units across UNM. Initial sales to the Hanson lab (Department of Biology) in Castetter Hall have raised over $1,500. These funds are earmarked for service and maintenance of the cryogenerator. In August, MSB Collection Manager Tom Giemakowski traveled to the Netherlands and received a week-long training and certification as a local maintenance engineer from the manufacturer.
## 2. TABLE OF COLLECTION ACTIVITY

<table>
<thead>
<tr>
<th>Metric</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection Growth</td>
<td>74,502 cryovials</td>
</tr>
<tr>
<td>Total cataloged specimens/cryovials:</td>
<td>213,147/507,906 (estimated)</td>
</tr>
<tr>
<td>MSB:Herp:</td>
<td>2,301/2,251</td>
</tr>
<tr>
<td>MSB:Para:</td>
<td>2,575/2815</td>
</tr>
<tr>
<td>MSB:Fish:</td>
<td>8,259/5,380</td>
</tr>
<tr>
<td>MSB:Bird:</td>
<td>20,098/36,699</td>
</tr>
<tr>
<td>MSB:Mamm:</td>
<td>182,489 /463,012</td>
</tr>
<tr>
<td>Loans (all consumable, outgoing loans)</td>
<td>Total: 53 loans, 2,168 samples</td>
</tr>
<tr>
<td>By Collection:</td>
<td>36 MSB:Mamm loans (1269 samples)</td>
</tr>
<tr>
<td></td>
<td>15 MSB:Bird loans (420 samples)</td>
</tr>
<tr>
<td></td>
<td>2 MSB:Herp loans (59 samples)</td>
</tr>
<tr>
<td>Specimen Records served via electronic databases</td>
<td>See separate division reports</td>
</tr>
<tr>
<td>Publications using the collection</td>
<td>See separate division reports</td>
</tr>
<tr>
<td>Citations of publications using the collection</td>
<td>See separate division reports</td>
</tr>
</tbody>
</table>

Geographic Distribution of DGR Loans issued in 2018
3. EDUCATIONAL IMPACTS OF THE COLLECTION

DGR employed two graduate student assistants, Jenna McCullough and Serina Brady, in 2018. The division employed and trained five undergraduate students, including three paid hourlies and two volunteers, and two community volunteers (see list in Section 8 below).

Examples of UNM student research supported by the DGR collection:

*Postdoctoral Students:*
  - Lisa Barrow, 1 loan, 229 bird tissue samples

*Master’s Students:*
  - Katrina Derieg, 1 loan, 31 mammal tissue samples
  - Paris Hamm, 3 loans, 90 mammal tissue samples
  - Dianne Peterson, 3 loans, 376 mammal ectoparasite samples

*Ph.D. Students*
  - Carlos Carrion, 2 loans, 33 mammal tissue samples
  - Jocelynn Colella, 3 loans, 85 mammal tissue samples
  - Jessie Williamson, 1 loan, 15 bird tissue samples

3a. COURSES USING THE COLLECTIONS

Natural Resource Management, Geography & Environmental Studies Department

3b. COURSES TAUGHT BY MSB PERSONNEL

<table>
<thead>
<tr>
<th>Instructor(s)</th>
<th>Sem</th>
<th>Course</th>
<th>Title</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Andersen</td>
<td>Spring 2018</td>
<td>Biol 191</td>
<td>Biodiversity</td>
<td>22</td>
</tr>
<tr>
<td>Michael Andersen</td>
<td>Fall 2018</td>
<td>Biol 303</td>
<td>Ecology and Evolution</td>
<td>155</td>
</tr>
</tbody>
</table>

4. COLLECTION MANAGEMENT

The National Science Foundation Collections in Support of Biological Research award #1561342 project is nearing completion with a requested one-year extension through 2020. All samples transferred to vapor-phase nitrogen have been inventoried, and effort is ongoing to finalize object tracking and linkage of parts to specimen voucher data records. The total number of samples transferred to vapor-phase nitrogen storage is over 145,000, representing over 70,000 cataloged specimens.
Growth of the Division of Genomic Resources was exceptionally high (15%) this year, with the addition of 74,502 cryovials. This includes 3,488 cryovials from Pecos, El Malpais, and Gila, and other New Mexico mammal and bird field expeditions that were transferred directly from liquid nitrogen into vapor-phase nitrogen storage. Other accessions include Solomon Islands birds, prep room bird and mammal tissues, and the large collection of NEON (National Ecological Observatory Network) samples. The NEON accessions include 41,203 mammal blood, ear clip, and fecal samples representing 20,254 individual mammals that were sampled over a multi-year period by mark / recapture. A majority of NEON tissues do not have voucher specimens, but some vouchers representing trap mortalities are archived, including organ tissues and parasites.

5. SCIENTIFIC PRODUCTS AUTHORED BY DIVISION PERSONNEL


6. SCIENTIFIC PRODUCTS BASED ON THE COLLECTION

See Publication lists for Division of Mammals, Birds, Reptiles and Amphibians and Fishes for publications related to genomic resources.

Number of GenBank accessioned DNA sequences currently associated with specimens in the Division of Genomic Resources.

<table>
<thead>
<tr>
<th>Collection code</th>
<th>Accessions in Genbank</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSB:Mamm</td>
<td>3,602</td>
</tr>
<tr>
<td>MSB:Bird</td>
<td>2,433</td>
</tr>
<tr>
<td>MSB:Herp</td>
<td>1,683</td>
</tr>
<tr>
<td>MSB:Para</td>
<td>663</td>
</tr>
<tr>
<td>MSB:Fish</td>
<td>88</td>
</tr>
<tr>
<td>MSB:Host</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8,481</strong></td>
</tr>
</tbody>
</table>

7. SERVICE AND OUTREACH

Presentations at Scholarly Meetings Related to Museum Collection Management:

- Society for the Preservation of Natural History Collections (SPNHC)+TDWG 2018 Joint Meeting, Conference Symposium: Challenges for Implementing Collections Data Quality

Service to Museum-Related Societies and Databases:

- Arctos Collection Management System and Biodiversity Database. Arctos Working Group Co-chair. Mariel Campbell.
- Arctos Collection Management System and Biodiversity Database. Arctos Working Group Treasurer. Teresa Jegelewicz Mayfield.
- Society for the Preservation of Natural History Collections. Managing Editor. Mariel Campbell

8. AFFILIATED PERSONNEL

A. Faculty & Staff

Michael Andersen, Curator
Mariel Campbell, Collection Manager
Teresa Jegelewicz Mayfield, Project Manager

B. Graduate students

Jenna McCullough, Division graduate assistant, Master’s degree (Andersen)
Serina Brady, Division graduate assistant, Master’s degree (Andersen)

C. Undergraduate Students

Avery Diercks, Student Employee
Emma Fries, Student Employee
Monica Naranjo, Student Employee
Blaque Armijo, Student Volunteer and Independent Study
Debby Mayberry, Student Volunteer

E. Community volunteers

Osa Day, high school intern
Sarah Dozal, community volunteer
1. HERBARIUM HIGHLIGHTS

The UNM Herbarium contained 136,663 specimens at the end of 2018. UNM has the largest collection of plant specimens in New Mexico, and is archived primarily for use in scientific research. Each specimen represents the field efforts of the collector and is mounted individually by student employees, databased, stored, and available for web-based, in-house, or outgoing-loan access by the public.
In our move to modernize the herbarium and make this resource available for wider use and enjoyment by the public we have imaged over seventy thousand specimens that are available for high-resolution viewing and research. This recent emphasis by the staff, student employees, and volunteers at the herbarium complements the fully databased and web-accessible holdings of this division of the museum. These resources are available through multiple internet portals that receive thousands of views per month.

2. TABLE OF COLLECTION USE

2018

1. Collection: growth & current size (New Specimens Cataloged/total specimens): 1150 / 136,663 Accessed and 1073 in our Teaching Collection

2. Loans Out: 17 (717 specimens).

3. Professional Visitors to the Collections: 191 plus tour groups.

4. Collection Database Web Site Hits: 22,000

5. Outside Publications Citing MSB Specimens: Unknown

6. Peer-Reviewed Publications by Staff: 0

7. Graduate Students (using or working in collections) - 4

8. Graduate Theses/Dissertations Completed (UNM/Other*) – 0, 0

9. Undergraduate Students (using or working in collections) - 11

3. EDUCATIONAL IMPACTS OF THE COLLECTION

3a. COURSES USING THE COLLECTIONS

ARTS 141. Introduction to Art and Ecology, 14 students
4. COLLECTION MANAGEMENT

As we enter the year, 2019, our focus is primarily on creating images of all of our specimens. Under various grants, including our most recent NSF grant, we have completed the imaging of 215 plant families, 1520 genera, 8586 species, and 2127 subspecific taxa. We serve over ninety thousand specimen images through both the SEINet (http://swbiodiversity.org) and iDigBio (https://www.idigbio.org/) portals. Our entire collection is digitized; all of the label information for over 136,000 specimens is available for use by the public and scientific research community.

We completed the remounting of a few thousand specimens from the early 1900s in 2016, and continue to remount older specimens as we encounter them within the imaging workflow. Many of these specimens are part of the Brother Arsene Collection; they were each imaged in their original condition and then removed from their acidic paper where possible. Once free they were mounted onto acid-free paper using modern techniques to preserve both the specimen and the historic label. Similarly, as we pull each specimen to image it, we have the opportunity to assess the status of the specimen and have found that many are in need of repairs. While this slows the imaging of specimens it gives us a unique opportunity to better curate the collection, repairing specimens that were mounted many years ago.

Our specimens traveled on loan to seventeen different institutions for taxonomic and systematic research this year. We received visits to our division by the botanical community as well as group visits by schools and organizations. We average 2-3 information requests per week by e-mail and/or phone, and the SEINet and iDigBio portals receive thousands of visits to our collection records.

While growth of the collection has slowed during our imaging initiative, access to, and usability of, the collection has grown tremendously. We have had the privilege of working with innovative bioinformatics programmers to maximize the availability of UNM’s collections and information to the national and international community. This year’s planning will lead to further growth and access to information.

Tim Lowrey, Curator of the Herbarium, has taken on the considerable task of completing a taxonomic key and treatment of the Asteraceae for the state’s illustrated flora, Flora Neomexicana. This treatment of the Sunflower Family includes 191 genera, 618 species, and 95 infraspecific taxa. Similarly, the Southwest Carex Working Group has, at times, taken up residence at the herbarium as they do the same for the Cyperaceae, or sedge family. Members include Max Licher, Jim McGrath, Bill Norris, and Glenn Rink. Max and Glen have also used our collection for their revision of the Juncaceae. As a result, almost all of our sunflowers, sedges, rushes, and bulrushes have been reviewed, verified, and revised within this process. These efforts greatly benefit our collections and provide a much-needed tool for investigation by scientists, enthusiasts, and the general public.
7. Service and Outreach

- Dr. Tim Lowrey:
  - Graduate Policy Committee
  - Faculty Senate Graduate and Professional Committee
  - M.S. Committee of M. Gattreaux
  - Ph.D. Committee of Karen Wright
  - Presidential Search Committee
  - Provost's Committee on Academic Success
  - Assoc. Deans of Research Advisory Committee
  - NM Rare Plant Technical Council
  - Graduate Teaching Academy
  - Research Associate, Missouri Botanical Garden, St. Louis, MO. 1985-present.

- Phil Tonne:
  - The UNM Museum Council
  - NM Rare Plant Technical Council

Interpretive activities or collections-related outreach includes tours for the public, including K-12 and UNM students. The Herbarium works closely with the Native Plant Society of New Mexico (NPSNM) and the New Mexico Rare Plant Technical Council, as well as local schools and the Bosque Ecosystem Monitoring Program.

8. Affiliated Personnel

A. Faculty/Staff

Tim Lowrey, Professor, Curator and Associate Dean
Phil Tonne, Senior Collection Manager

B. Graduate students

Lauren Bansbach, Herbarium Graduate Assistant.
Andrea Lopez, Herbarium Graduate Assistant.
Kyle Robinson, Graduate Student Employee.
C. Undergraduate Student Workers and Volunteers

LeeRoy Allen
Mari Aoki
Kenzie De Leon
JoLynn Fenger
Gwen Houston-Hatton
Trent Llewellyn
Courtney Love
Hedda Oeritsland
Madison Paulk
Pricilla Camila De la Pena Schott
Samantha Stutz

D. Research Associates

Daniela Roth, State Forestry Division Botanist, EMNRD.
Robert Sivinski, retired State Forestry Division Botanist; botanical consultant at present.

AWARDS, GRANTS, AND CONTRACTS

Our NSF grant for imaging of the collection was awarded in 2017 and remains in force. This grant comprised $190,944 to image and georeference the plants of the Southern Rocky Mountains. This collaborative, multi-institutional (37 partners) grant is funded by NSF’s Advancing Digitization of Biodiversity Collections (ADBC) and aims to mobilize data from approximately two million herbarium specimens to help understand global environmental change. As we go through this 4-year process, imaged and georeferenced specimen data are added and available through the SEINet (http://swbiodiversity.org) and iDigBio portals. Students are participating in this opportunity to expand accessibility and utility of our amazing collection of plants (now over 135,000 specimens and over 10,300 species represented).
1. DIVISION HIGHLIGHTS

In 2018, the Division of Mammals (DOM) gained significant new holdings of specimens (now 2nd largest mammal collection worldwide), supported a large number of peer-reviewed publications (>90), played a role in graduating several undergraduate and graduate students, established a new endowed research fellowship for mammalogy students (Findley Fund), and completed a large project with the National Ecological Observatory Network. We also experienced a significant loss, however. On May 20, Founding Director and long-time (1955-1978) Curator of Mammals of The Museum of Southwestern Biology, James S. Findley died at the age of 92. During his highly productive career at UNM, Jim mentored 50 graduate students, was President of the American Society of Mammalogists, and served as Chair of the Biology Department. His wit, humor, insights, and fairness will be sorely missed (see obituary in J. Mammalogy 100: 599-607).

A. MSB DOM Recognition.

DOM saw substantial national and international exposure for collection related activity.

a. The DOM surpassed the British Museum in size and is now the 2nd largest collection in the world with over 320,000 specimens.

b. DOM staff published 17 papers, many of which are establishing new directions for field sampling, data integration, host-pathogen relationships, and archival best practices.


c. Joe Cook promoted to Regents’ Professor, University of New Mexico
e. Jocie Colella awarded the Shadle Fellowship, American Society of Mammalogists “The impact of introgression on mammalian evolution.” $4800

**B. Infrastructure development.** The DOM grew to 322,371 specimens in 2018, adding nearly 20,000 new specimens and now representing >1,700 species from 78 countries.

**C. Training in specimen-based research and curation.** Training remains an integral goal of the DOM, principally through Biology, Anthropology, Museum Studies and Fine Arts. Students associated with the collection as workers or volunteers gain experience in bioinformatics, natural history specimen preparation, curation, and field and laboratory-based research. Students were involved in all activities of the division during 2018. This year we saw a significant increase in volunteer help and logged 1900 hours of unpaid volunteer work.

a. 18 UNM students worked in the division in 2018
   i. 2 graduate students
   ii. 5 paid undergraduates
   iii. 11 volunteer undergraduates
   iv. Of these 18:
       1. 14 females
       2. 4 males

b. 68 Albuquerque Public Schools high school interns/volunteers
c. 11 other volunteers from various institutions

**D. Publications utilizing MSB DOM specimens or data.** The DOM collection continues to be utilized heavily by a wide range of disciplines and is the basis for a large number of peer-reviewed publications, agency reports, and policy directives. Tracking every publication that utilizes our specimens is difficult, as not all authors are careful to acknowledge use of DOM specimens. Thus, the number of publications utilizing our material should be viewed as an underestimate.

During 2018 DOM specimens were cited or specimen data were utilized in at least 94 studies published in 71 journals:
E. **Theses/Dissertations.**
   a. In 2018, at least 8 theses or dissertations were completed that utilized MSB mammal specimens.

F. **New Initiatives:** we have undertaken a collaboration with John Korbin from Sandia National Labs to CT scan both skeletal and fluid preserved specimens. This collaboration has already resulted in hundreds of high quality scans and 3D printed models which are excellent tools for outreach and education. These large data files will be posted to MorphoSource administered through Duke University.

2. **TABLE OF COLLECTION ACTIVITY**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection Growth</td>
<td>19,611</td>
</tr>
<tr>
<td>Loans (outgoing (# specimens)/ incoming (# specimens)</td>
<td>109 (3,158) / 6 (93)</td>
</tr>
<tr>
<td>Specimen Records served via electronic databases</td>
<td>49,771 / 66,318,909</td>
</tr>
<tr>
<td>Publications using the collection</td>
<td>94 (+ 8 theses/dissertations)</td>
</tr>
<tr>
<td>Citations of publications using the collection</td>
<td>5,057 (2018) – 75,850 (total)</td>
</tr>
</tbody>
</table>

Google scholar profile: https://scholar.google.com/citations?user=kBYStSsAAAAJ&hl=en

3. **EDUCATIONAL IMPACTS OF THE COLLECTION**

• Three theses or dissertations were completed by DOM students in 2018.

• 18 undergrad or grad students received experience and training while working in the DOM collections.

• 34 graduate students examined specimens or received loans of material for theses or dissertation projects.

• 3 COMEXUS students (undergrad) from Mexico for 6 weeks and 1 LSAMP student (4 weeks) in summer 2018.

• 11 K-12 schools visited and/or received presentations on the use and value of natural history collections and evolution/adaptations.
  o Cibola HS
  o Albuquerque HS
  o Sandia HS
  o Estancia HS
3a. COURSES USING THE COLLECTIONS

24 UNM Classes receiving specimens, visits, or presentations from the Division of Mammals.

<table>
<thead>
<tr>
<th>Course</th>
<th>Semester</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 204L - Plant and Animal Form and Function</td>
<td>Spring</td>
<td>180</td>
</tr>
<tr>
<td>BIOL 204L - Plant and Animal Form and Function</td>
<td>Fall</td>
<td>180</td>
</tr>
<tr>
<td>BIOL 203L – Ecology and Evolution.</td>
<td>Spring</td>
<td>240</td>
</tr>
<tr>
<td>BIOL 203L – Ecology and Evolution.</td>
<td>Fall</td>
<td>240</td>
</tr>
<tr>
<td>BIOL 386L – General Vertebrate Zoology.</td>
<td>Fall</td>
<td>30</td>
</tr>
<tr>
<td>BIOL 386L – General Vertebrate Zoology.</td>
<td>Spring</td>
<td>40</td>
</tr>
<tr>
<td>BIOL 389L – Mammalogy</td>
<td>Fall</td>
<td>17</td>
</tr>
<tr>
<td>BIOL 699 – Dissertation</td>
<td>Spring</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 699 – Dissertation</td>
<td>Fall</td>
<td>2</td>
</tr>
<tr>
<td>ART 429/BIOL 419 – Art and Biodiversity</td>
<td>Fall</td>
<td>12</td>
</tr>
<tr>
<td>BIOL – Ecology of the Past</td>
<td>Fall</td>
<td>20</td>
</tr>
<tr>
<td>ART /ART HIST – Drawing I (2 sections)</td>
<td>Fall</td>
<td>41</td>
</tr>
<tr>
<td>Arts 191</td>
<td>Fall</td>
<td>14</td>
</tr>
<tr>
<td>BIOL 461/561 (Tropical Biology)</td>
<td>Spring</td>
<td>15</td>
</tr>
<tr>
<td>MSST 476/576 Mus Studies</td>
<td>Spring</td>
<td>8</td>
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<tr>
<td>MSST 476/576 Mus Studies</td>
<td>Fall</td>
<td>14</td>
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<tr>
<td>BIOL - Museum Curation</td>
<td>Spring</td>
<td>18</td>
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<tr>
<td>BIOL 402 – Museum Scientific prep</td>
<td>Spring</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 499 – undergrad problems</td>
<td>Spring</td>
<td>1</td>
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<tr>
<td>BIOL 551 Research problems</td>
<td>Spring</td>
<td>2</td>
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<tr>
<td>BIOL 551 Research problems</td>
<td>Fall</td>
<td>2</td>
</tr>
<tr>
<td>BIOL 400 – Senior honors thesis</td>
<td>Fall</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 402 – Phylogenomics</td>
<td>Spring</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 402 – Museomics</td>
<td>Spring</td>
<td>1</td>
</tr>
</tbody>
</table>
3b. COURSES TAUGHT BY MSB PERSONNEL

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Semester</th>
<th>Course</th>
<th>Title</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Cook, Joseph</td>
<td>Spring</td>
<td>BIOL 402 U 006</td>
<td>T: Phylogenomics</td>
<td>2</td>
</tr>
<tr>
<td>*Cook, Joseph</td>
<td>Spring</td>
<td>BIOL 402 U 053</td>
<td>T: Museomics</td>
<td>1</td>
</tr>
<tr>
<td>*Cook, Joseph; Dunnum, Jonathan</td>
<td>Spring</td>
<td>BIOL 402 U 037</td>
<td>T: Mammal Sci Prep</td>
<td>1</td>
</tr>
<tr>
<td>*Cook, Joseph</td>
<td>Spring</td>
<td>BIOL 461L U 002</td>
<td>Intro to Tropical Biol.</td>
<td>10</td>
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<tr>
<td>*Cook, Joseph</td>
<td>Spring</td>
<td>BIOL 499 U 007</td>
<td>Undergrad Problems</td>
<td>1</td>
</tr>
<tr>
<td>*Cook, Joseph</td>
<td>Spring</td>
<td>BIOL 551 M 007</td>
<td>Research Problems</td>
<td>2</td>
</tr>
<tr>
<td>*Cook, Joseph</td>
<td>Spring</td>
<td>BIOL 561 M 001</td>
<td>Tropical Biology</td>
<td>5</td>
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<tr>
<td>*Cook, Joseph</td>
<td>Spring</td>
<td>BIOL 699 P 007</td>
<td>Dissertation</td>
<td>3</td>
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<tr>
<td>*Cook, Joseph</td>
<td>Fall</td>
<td>BIOL 699 P 007</td>
<td>Dissertation</td>
<td>2</td>
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<tr>
<td>*Cook, Joseph</td>
<td>Fall</td>
<td>BIOL 551 M 007</td>
<td>Research Problems</td>
<td>2</td>
</tr>
<tr>
<td>*Cook, Joseph</td>
<td>Fall</td>
<td>BIOL 400 U 007</td>
<td>Senior Honors Thesis</td>
<td>1</td>
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<tr>
<td>*Cook, Joseph</td>
<td>Fall</td>
<td>BIOL 489L U 001</td>
<td>Mammalogy</td>
<td>17</td>
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<tr>
<td>*Cook, Joseph</td>
<td>Fall</td>
<td>BIOL 402 U 054</td>
<td>T: Evol. Genomics</td>
<td>1</td>
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</tbody>
</table>

4. COLLECTION MANAGEMENT

Collection Growth. The DOM cataloged 19,611 new specimens during 2018 and now curates 322,371 specimens. The collection is now the 2nd largest collection in the world. New accessions (111) of mammalian material amounted to >5,000 specimens.

The continued exceptional growth is the result of several facets of our operation:

a. Specimen growth through fieldwork
   i. Directed specimen-based field studies related to Joseph Cook’s research program.

b. Specimen growth through donation
   i. A well-developed network of researchers and agencies worldwide continue to deposit their material in DOM.
      a. National Ecological Observatory Network (NEON)
      b. USFWS – Mexican wolf recovery program
      c. USDA – Animal Damage Control
      d. Panamanian Health Department – Gorgas
      e. Alaska Department of Fish and Game
5. SCIENTIFIC PRODUCTS AUTHORED BY DIVISION PERSONNEL


6. SCIENTIFIC PRODUCTS BASED ON THE COLLECTION


75. Soberón, Jorge, A. Townsend Peterson, and Luis Osorio-Olvera. "A comment on" Species are not most abundant in the center of their geographic range or climatic niche". *bioRxiv* (2018): 266510. Data download


84. Van der Geer, Alexandra AE, Mark V. Lomolino, and George Lyras. "‘On being the right size’—Do aliens follow the rules?." *Journal of Biogeography* 45, no. 3 (2018): 515-529. Data download


Theses/Dissertations


7. SERVICE AND OUTREACH

- Hosted 57 researchers in the collections from 32 institutions or UNM departments.
- Gave presentations on MSB and value and use of natural history research collections to:
  - 6 UNM classes
  - 11 area K-12 schools
• Bernalillo County Master Naturalists
• Pueblo of Isleta Environmental Fair
• Sandia Labs environmental science fair
• Many other visiting community members

• J.A. Cook committee service
  • Latin American Institute Scholarships Committee, UNM
  • Mammal Conservation Committee, American Society of Mammalogists
  • Student Science Policy Committee, American Society of Mammalogists
  • Moderator, The Last Oil; UNM Symposium on Arctic National Wildlife Refuge
  • Commission Member, IUCN Species Survival Commission, Small Mammal Specialist Group
  • Faculty Sponsor, Student Chapter, UNM Wild

• J.L. Dunnum committee service
  • Systematic Collections Committee, American Society of Mammalogists
  • Latin American Awards Committee, American Society of Mammalogists
  • IACUC, UNM
  • Arctos Database Working Group
  • NEON Scientific Research Collections Technical Working Group

8. AFFILIATED PERSONNEL

A. Faculty & Staff

• J.A. Cook, Curator
• J.L. Dunnum, Collection Manager
• M.A. Bogan, Emeritus Curator
• J.S. Findley, Emeritus Curator
• Stephen O. MacDonald, Curator II (retired)
• Adrienne Raniszewski, Curatorial Associate

B. Graduate students

• Jessica Weber. 8th year Ph.D student. Hypoxia tolerance and adaptive responses in Caviomorph rodents.
• Colella, Jocie. 6th year Ph.D student. *Mixing it up: the impact of episodic introgression on the evolution of high-latitude meso-carnivores.*
• Liphardt, Schuyler. 4th year Ph.D. student. Hantavirus evolution.
• Carrion, Carlos. 4th year Ph.D. student. Systematics of Neotropical Myotis.
• Peterson, Dianne. 2nd year M.S. student. *Onychomys* and plague dynamics.
• Campbell, Mariel. 2nd year PH.D. student.
• Jones, Kaylen. 3rd year M.S. Museum studies student.
• Frederick, Lindsey. 3rd year M.S. Museum studies student.
• Derieg, Katrina. 1st year M.S. student. *Neotoma* spp. systematics and phylogeography.

C. Undergraduate Students

Employees

• Alex Olivas
• Keila Gutierrez
• Rabia Khan
• Somiya Dunnnum
• Teah Armikabirian

Class or program requirement volunteer

• Alec Wyatt – Bernalillo co. Master Naturalist
• Debby Maberry – UNM, Museum Studies
• Gabriella Salazar - COMEXUS
• Lizette González - COMEXUS
• Marissa Breslin - UNM
• Monica Villegas – AMP SCORE Summer program
• Noemi Santana – COMEXUS

Volunteer

• Aurelia Dixon - UNM
• Danielle Parsons - UNM
• Hailey Patterson - UNM
• Jessie Smith - Eastern New Mexico University
• Katrina Derieg - UNM
• Maddie Jeshurin - UNM
• Maria Gigliotti - UNM
• Nanda Ramos - Eckerd College
• Pooja Bhakta - UNM
• Sophie Farr - UNM
• Tommy Galfano - UNM

D. Research Associates

Curatorial Associates

• Jerry W. Dragoo, State Veterinary Lab
• William Gannon, UNM Graduate Studies
• David J. Schmidly, UNM Department of Biology (emeritus)

Research Associates

• J. Scott Altenbach, UNM Department of Biology (retired), NM
• Sydney Anderson, American Museum of Natural History (retired), NY
• Robert J. Baker, The Museum, Texas Tech University, Lubbock, TX
• Troy L. Best, Department of Biology, Auburn University (retired), AL
• Fernando Cervantes, UNAM, Mexico City, Mexico
• Paul J. Cryan, Ft. Collins, CO
• Natalie Dawson, University of Montana, Missoula, MT
• John Demboski, Denver Museum of Science and Nature, Denver, CO
• Guillermo D’Elia, Universidad de Valdivia, Chile
• Jennifer K. Frey, NMSU, Las Cruces, NM
• Kurt Galbeath, Northern Michigan University, Marquette, MI
• Scott L. Gardner, Dept. Nematology, Curator, University Nebraska, NE
• Keith Geluso, University of Nebraska, Lincoln, NE
• Ken Geluso, Albuquerque, NM
• David J. Hafner, New Mexico Museum Nat. History (retired)
• Art Harris, University of Texas (retired), El Paso, Texas
• Heikki Henttonen, Finnish Forest Research Institute, Finland
• Edward J. Heske, Illinois Biological Survey, IL
• Eric Hoberg, Beltsville, MD
• Andrew Hope, Kansas State University, Manhattan, KS
• Tom Jung, Whitehorse, Yukon
• Sue Kutz, University of Calgary, Alberta
• Enrique Lessa, Universidad de la Republica, Montevideo, Uruguay
• Stephen MacDonald, Gila, NM
• Jason Malaney, Austin Peay State University, TN
• Michael Mares, Oklahoma University, Norman, OK
• Pablo Marquet, Universidad Catolica, Santiago, Chile
• Rodrigo Medillín, UNAM, Mexico City, Mexico
• Gary Morgan, New Mexico Museum Natural History, NM
• Eduardo Palma, Universidad Catolica, Santiago, Chile
• Robert Parmenter, Valles Caldera, Jemez, NM
• James L. Patton, Museum of Vertebrate Zoology (retired), Berkeley, California
• Reggie Rausch, Burke Museum, University of Washington, Seattle, WA
• Brett R. Riddle, University of Nevada, Las Vegas, NV
• Jorge Salazar Bravo, Texas Tech University, Lubbock, TX
• C. Greg Schmitt, Farmington, NM
• Sandy Talbot, Molecular Ecology Lab- USGS Anchorage, AK
• Fernando Torres Perez, Vina del Mar, Chile
• Ernie Valdez, USGS-UNM, Tijeras, NM
• Jack Whitman, Ketchum, ID
• Don E. Wilson, Smithsonian (retired), Washington, DC
• Nyamsuren Batsaikhan, National University of Mongolia, Ulaan Baatar
E. Community volunteers

- Destiny Frey - Amy Biehl High School (fulfilling program/class requirement)
- Quentin Drake - Amy Biehl High School (fulfilling program/class requirement)
- Samantha Candelaria-Ley - Amy Biehl High School (fulfilling program/class requirement)
- Hazen Augé - Cleveland High School (volunteer)
- Lizzy Enos - Bosque School (volunteer)
- Quentin Ennis - Albuquerque Academy (volunteer)
- Sierra Romero - Albuquerque High School (volunteer)
- Zora Lehmer-Mearns - Albuquerque High School (volunteer)
- Various - Amy Biehl High School (fulfilling program/class requirement, 10 students on average, 6 visits, 2 hours each)
- Amy Ewing - Master Naturalist (fulfilling program/class requirement)
- Ann Racehorse - Master Naturalist (fulfilling program/class requirement)
- Brandt Magic - (fulfilling program/class requirement)
- Kody Baumgardner - UNM, Continuing Education post-bac (fulfilling program/class requirement)

In the Mammal Range, Somiya Dunnnum and Rabia Khan, student associates of the Division of Mammals, explain the differences among rodent species of New Mexico at MSB's annual open collections event.
MSB Division of Parasites: 2018 Annual Report

1. DIVISION HIGHLIGHTS

The 2018 highlights include a major donation from Dr. Eric P. Hoberg, Research Associate of the Division of Parasites, and former curator of the National Parasite Collection. Dr. Hoberg’s donation included Arctic and Antarctic parasite specimens, mostly helminths from birds and marine mammals. This collection is extraordinarily unique and valuable from a scientific research and taxonomic perspective.

During 2018, two students graduated with their Ph.D.'s — Drs. Erika Ebbs and Martina Laidemitt. These two students worked for several years on projects relating to the Division of Parasites, and both spent multiple semesters as graduate assistants in the collection. Their dissertation projects contributed substantially to the growth of the collection, and their publications contributed to its prominence.

2. TABLE OF COLLECTION ACTIVITY

<table>
<thead>
<tr>
<th>Metric</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>Collection Growth</td>
<td>2,276 Parasite specimens (lots); 826 Host specimens (lots)</td>
</tr>
<tr>
<td>Loans (outgoing(no. of specimens)/incoming (no. of specimens)</td>
<td>3 (63)/2 (63)</td>
</tr>
<tr>
<td>Specimen Records served via electronic databases</td>
<td>Arctos: 14,959 queries-5,874,844 records served.</td>
</tr>
<tr>
<td>Publications using the collection</td>
<td>8</td>
</tr>
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</table>

3. EDUCATIONAL IMPACTS OF THE COLLECTION

3a. COURSES USING THE COLLECTIONS

BIOL 239, Microbiology for Health Science Majors, spring & fall semesters, 200 students

5. SCIENTIFIC PRODUCTS AUTHORED BY DIVISION PERSONNEL


6. SCIENTIFIC PRODUCTS BASED ON THE COLLECTION


8. AFFILIATED PERSONNEL

A. Faculty & Staff

  Dr. Eric S. Loker, Curator
  Dr. Sara V. Brant, Senior Collections Manager

B. Graduate students

  Caitlin Babbitt
  Coltin Gerhart
  Emily Sarvis

D. Research Associates

  Dr. Eric Hoberg

E. Community volunteers

  Alex Price
Extramural funding: Awards that were active during 2018, sorted by project start date, totaling ~$1.8 million.

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Lead PI</th>
<th>Unit</th>
<th>Sponsor</th>
<th>Award Amount</th>
<th>Award Begin Date</th>
<th>Award End Date</th>
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</thead>
<tbody>
<tr>
<td>MSB Division of Genomic Resources Facilities Upgrade</td>
<td>Joseph Cook</td>
<td>Mammals, Genomic Resources, Birds</td>
<td>National Science Foundation</td>
<td>$433,598.00</td>
<td>3/1/16</td>
<td>4/30/19</td>
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<tr>
<td>Diversity and distribution of avian malaria in New Mexico under climate change</td>
<td>Christopher Witt</td>
<td>Birds</td>
<td>U.S. Department of the Interior Bureau of Land Management</td>
<td>$10,000.00</td>
<td>7/7/16</td>
<td>7/31/21</td>
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<tr>
<td>&quot; &quot;</td>
<td>Christopher Witt</td>
<td>Birds</td>
<td>U.S. Department of the Interior Bureau of Land Management</td>
<td>$35,000.00</td>
<td>7/7/16</td>
<td>7/31/21</td>
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<tr>
<td>Improved archiving of Mexican wolf (Canis lupus baileyi) specimens in the MSB Division of Mammals</td>
<td>Jonathan Dunnum</td>
<td>Mammals</td>
<td>US Fish &amp; Wildlife Service</td>
<td>$15,000.00</td>
<td>9/1/16</td>
<td>8/31/21</td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>Jonathan Dunnum</td>
<td>Mammals</td>
<td>US Fish &amp; Wildlife Service</td>
<td>$15,000.00</td>
<td>9/1/16</td>
<td>8/31/21</td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>Jonathan Dunnum</td>
<td>Mammals</td>
<td>US Fish &amp; Wildlife Service</td>
<td>$15,000.00</td>
<td>9/1/16</td>
<td>8/31/21</td>
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<tr>
<td>Rio Puerco Mammal Studies - BLM</td>
<td>Joseph Cook</td>
<td>Mammals</td>
<td>U.S. Department of the Interior Bureau of Land Management</td>
<td>$32,000.00</td>
<td>9/1/16</td>
<td>8/31/18</td>
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<td>&quot; &quot;</td>
<td>Joseph Cook</td>
<td>Mammals</td>
<td>U.S. Department of the Interior Bureau of Land Management</td>
<td>$45,000.00</td>
<td>9/1/16</td>
<td>9/30/21</td>
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<tr>
<td>Collaborative Research: Discovery and analysis in the cradle of speciation theory: biotic surveys of Melanesia's terrestrial vertebrates</td>
<td>Michael Andersen</td>
<td>Genomic Resources</td>
<td>National Science Foundation</td>
<td>$348,769.00</td>
<td>9/15/16</td>
<td>8/31/21</td>
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<tr>
<td>Promoting Undergraduate Research in Systematics: Insects as a Template for Training</td>
<td>Kelly Miller</td>
<td>Arthropods</td>
<td>Department of Agriculture</td>
<td>$20,000.00</td>
<td>9/28/16</td>
<td>9/27/21</td>
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<td>&quot; &quot;</td>
<td>Kelly Miller</td>
<td>Arthropods</td>
<td>Department of Agriculture</td>
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<td>9/28/16</td>
<td>9/27/21</td>
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<td>&quot; &quot;</td>
<td>Kelly Miller</td>
<td>Arthropods</td>
<td>Department of Agriculture</td>
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<td>9/28/16</td>
<td>9/27/21</td>
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<td>Where do Chilean coastal Giant Hummingbirds (Patagona gigas) go during the austral winter?</td>
<td>Christopher Witt</td>
<td>Birds</td>
<td>Nuttall Ornithological Club</td>
<td>$4,000.00</td>
<td>12/17/16</td>
<td>1/31/18</td>
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<td>Distribution of Gila Monsters in southwestern New Mexico</td>
<td>Jacek Giermakowski</td>
<td>Herps</td>
<td>New Mexico Game and Fish Department</td>
<td>$21,358.00</td>
<td>2/13/17</td>
<td>1/31/18</td>
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<tr>
<td>MSB Division of Genomic Resources Facilities Upgrade</td>
<td>Jacek Giermakowski</td>
<td>Herps</td>
<td>National Science Foundation</td>
<td>$66,378.00</td>
<td>4/13/17</td>
<td>4/30/19</td>
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<tr>
<td>Survey and Monitoring of the Narrow-headed Gartersnake, Thamnophis rufipunctatus, to Forward Its Recovery</td>
<td>Joseph Cook</td>
<td>Mammals</td>
<td>Western New Mexico University</td>
<td>$3,000.00</td>
<td>4/27/17</td>
<td>6/30/18</td>
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</table>

2018 Extramural Funding Table
<table>
<thead>
<tr>
<th>Project Description</th>
<th>Principal Investigator</th>
<th>Discipline</th>
<th>Funding Agency</th>
<th>Amount</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution and population connectivity of Merriam’s ground squirrel</td>
<td>Joseph Cook</td>
<td>Mammals</td>
<td>US Fish &amp; Wildlife Service</td>
<td>$10,000.00</td>
<td>5/24/17</td>
<td>6/30/19</td>
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<tr>
<td>Diversity and distribution of avian malaria in New Mexico under climate change</td>
<td>Christopher Witt</td>
<td>Birds</td>
<td>U.S. Department of the Interior</td>
<td>$45,000.00</td>
<td>6/7/17</td>
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<td>PRFB Workshop - Research Using Biological Collections</td>
<td>Joseph Cook</td>
<td>Mammals</td>
<td>National Science Foundation</td>
<td>$98,172.00</td>
<td>8/1/17</td>
<td>7/31/18</td>
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<tr>
<td>Hybridization/introgression within and among mesocarnivore species</td>
<td>Joseph Cook</td>
<td>Mammals</td>
<td>US Geological Survey</td>
<td>$10,405.00</td>
<td>8/15/17</td>
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<tr>
<td>Digitization TCN: Collaborative Research: Using Herbarium Data To Document Plant N</td>
<td>Timothy Lowrey</td>
<td>Herbarium</td>
<td>National Science Foundation</td>
<td>$190,944.00</td>
<td>9/1/17</td>
<td>8/31/21</td>
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<tr>
<td>Diversity and distribution of avian malaria in New Mexico under climate change</td>
<td>David Lightfoot</td>
<td>Arthropods</td>
<td>Sandia National Laboratories</td>
<td>$7,995.00</td>
<td>3/12/18</td>
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<tr>
<td>Hybridization/introgression within and among mesocarnivore species</td>
<td>Thomas Turner</td>
<td>Fishes</td>
<td>Bureau of Reclamation</td>
<td>$293,883.00</td>
<td>4/16/18</td>
<td>9/30/22</td>
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<tr>
<td>Survey and Monitoring of the Narrow-headed Gartersnake, Thamnophis rufipunctatus,</td>
<td>Jacek Giermakowski</td>
<td>Herps</td>
<td>Western New Mexico University</td>
<td>$3,000.00</td>
<td>7/1/18</td>
<td>6/30/19</td>
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<tr>
<td>to Forward Its Recovery</td>
<td>Jacek Giermakowski</td>
<td>Herps</td>
<td>Western New Mexico University</td>
<td>$3,000.00</td>
<td>7/1/18</td>
<td>9/30/19</td>
</tr>
<tr>
<td>Hybridization/introgression within and among mesocarnivore species</td>
<td>Joseph Cook</td>
<td>Mammals</td>
<td>US Geological Survey</td>
<td>$10,000.00</td>
<td>9/24/18</td>
<td>9/30/19</td>
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<tr>
<td>Total awards active in 2018</td>
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<td></td>
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<td>$1,796,502.00</td>
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</table>
Google Scholar profiles for individual collections provide an innovative way for MSB to track the research impacts of its holdings. Scientific products (peer-reviewed papers, dissertations, etc.) can be compiled, summarized, and measured by citation impacts. Here are summary views for MSB's collection profiles to date.

### MSB Amphibians and Reptiles: publications based on specimens

The University of New Mexico
Verified email at unm.edu - Homepage

**Herpetology**

<table>
<thead>
<tr>
<th>Title</th>
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<tbody>
<tr>
<td>A global test of ecoregions</td>
<td></td>
<td>5 2016</td>
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<tr>
<td>JR Smith, AD Leston, PJ Ke, GS Anderson, JN Hendershot, MK Dhami, ...</td>
<td></td>
<td></td>
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<tr>
<td>Nature ecology &amp; evolution 2 (12), 1889</td>
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<tr>
<td>Climatic Niche Dynamics and Its Role in the Insular Endemism of Anolis Lizards</td>
<td></td>
<td>2018</td>
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<tr>
<td>JA Velasco, E Martinez-Meyer, O Flores-Villena</td>
<td></td>
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<tr>
<td>Evolutionary Biology 45 (3), 345-357</td>
<td></td>
<td></td>
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<tr>
<td>Comparison of climate vulnerability among desert herpetofauna</td>
<td></td>
<td>4 2018</td>
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### Division of Birds: Publications based on the collection

Museum of Southwestern Biology, University of New Mexico
Verified email at unm.edu - Homepage

Specimen-based research  Birds  Ornithology  Evolutionary Biology

<table>
<thead>
<tr>
<th>Title</th>
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<tbody>
<tr>
<td>Comprehensive DNA barcode coverage of North American birds</td>
<td>537</td>
<td>2007</td>
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<tr>
<td>KOR Kerr, MY Sleeskie, CJ Dove, LA Weigt, CM Francis, PDN Hebert</td>
<td></td>
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</tr>
<tr>
<td>Molecular ecology notes 7 (4), 535-543</td>
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<tr>
<td>Molecular phylogenetics and the diversification of hummingbirds</td>
<td>226</td>
<td>2014</td>
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<tr>
<td>JA McGuire, CC Witt, JV Remsen Jr, A Carti, DL Rabosky, DL Altshuler, ...</td>
<td></td>
<td></td>
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<tr>
<td>Current Biology 24 (8), 910-916</td>
<td></td>
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<tr>
<td>Reproductive interdependence of pinon jays and pinon pines</td>
<td>182</td>
<td>1976</td>
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</table>

Citations  h-index  i10-index
All 3601 38 131
Since 2014 3938 33 89
### Division of Mammals: publications by affiliated personnel or based on the collection

**Museum of Southwestern Biology**  
Verified email at unm.edu - [Homepage](#)

- **mammals**  
- **conservation**  
- **systematics**  
- **evolution**  
- **ecology**

<table>
<thead>
<tr>
<th>TITLE</th>
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<tbody>
<tr>
<td>Ecopathological of Alphaviruses and Flaviviruses</td>
<td></td>
<td>2020</td>
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<td>C Guzmán, A Calderón, S Mattar, L Tadeo-FIGUEREDO, J Salazar-Bravo, ...</td>
<td></td>
<td></td>
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<tr>
<td>Emerging and Reemerging Viral Pathogens, 101-125</td>
<td></td>
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<td>Taxonomy of the Sylvilagus brasiliensis complex in Central and South America (Lagomorpha: Leporidae)</td>
<td></td>
<td>2019</td>
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<td>LA Ruedas, SM Silva, JH French, RN Platt, J Salazar-Bravo, JM Mora, ...</td>
<td></td>
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<tr>
<td>Journal of Mammalogy</td>
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### MSB Division of Fishes

**University of New Mexico**  
Verified email at unm.edu - [Homepage](#)

- **Desert fishes**  
- **ecology**  
- **aquatic research**  
- **stable isotope study**  
- **genetics**

<table>
<thead>
<tr>
<th>TITLE</th>
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<th>YEAR</th>
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<tbody>
<tr>
<td>Reproductive strategies and egg types of seven Rio Grande basin cyprinids</td>
<td>203</td>
<td>1998</td>
</tr>
<tr>
<td>SP Platania, CS Altenbach</td>
<td></td>
<td></td>
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<td>Copeia, 559-569</td>
<td></td>
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<tr>
<td>Status and conservation of the Rio Grande silvery minnow, Hybognathus amarus</td>
<td>152</td>
<td>1991</td>
</tr>
<tr>
<td>KR Bestgen, SP Platania</td>
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<tr>
<td>The Southwestern Naturalist, 225-232</td>
<td></td>
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<td>FLOW REGULATION AND FRAGMENTATION IMPERIL PELAGIC-SPAWNING RIVERINE FISHES</td>
<td>148</td>
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### Cited by

- **Citations**  
  - **All**: 30650  
  - **Since 2014**: 64

- **h-index**: 119  
  - **Since 2014**: 64

- **i10-index**: 1068  
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