Museums for America

Sample Application MA-30-19-0524-19
Project Category: Collections Stewardship and Public Access

Museum of Vertebrate Zoology, University of California

Amount awarded by IMLS:	$148,129
Amount of cost share:	$148,561

Attached are the following components excerpted from the original application.

- Abstract
- Narrative
- Schedule of Completion

Please note that the instructions for preparing applications for the FY2020 Museums for America grant program differ from those that guided the preparation of FY2019 applications. Be sure to use the instructions in the FY2020 Notice of Funding Opportunity for the grant program and project category to which you are applying.

The Museum of Vertebrate Zoology (MVZ) project, "Stewardship of the Ornithology Collection of the Museum of Vertebrate Zoology," addresses a high priority need for the museum by rehousing a major section of non-passerine bird skins in 74 new cases to provide urgently needed pest protection for one of the most important, but currently vulnerable, bird collections in the United States. It also allows the purchase of 400 new aluminum trays which have advantages over existing wooden trays in terms of pest protection, weight loading, and spacing in cases. This project will accomplish a major goal of the museum's strategic plan for stewardship of its collections, and will further the MVZ's mission of remaining a leading center for the specimen-based study of vertebrates and for innovative uses of natural history collections for research, education, and solving problems related to biodiversity conservation.

Over the past 10 years, the MVZ has been working strategically to better preserve and protect its Ornithology collection. This prior work includes two projects, funded by the National Science Foundation,that involved rehousing the MVZ egg and passerine skin collections. The proposed one year project, which requires $148,129 in IMLS grant funds, will allow the MVZ to rehouse a major section of non-passerine skins that receives heavy use (penguins, loons, gulls, alcids, and hawks). In addition, by focusing on this section of the collection, the museum will be able to add space for new acquisitions of large-bodied birds (e.g., seabirds and hawks) that it has received recently. These modern cases will replace early 1900s-era cases that are in poor condition and do not adequately protect skins from potential pest damage. Rehousing the collection also provides an opportunity to move specimens into new aluminum trays that provide better pest protection and provide more efficient storage in cases. The collection is heavily used for research, teaching, and public outreach, and strategic stewardship will ensure long-term protection and access.

Success of the project will be measured by the accomplishment of three major project activities: (1) rehousing of specimens into 74 new cases; (2) moving specimens from old wooden trays to 400 new aluminum trays; and (3) relabeling tags, trays, and cases as needed based on a recently updated organization and taxonomy.

The MVZ is committed to long-term stewardship of its collections through proper housing and dedicated support. The MVZ Ornithology collection has two full-time curators (PIs Cicero and Bowie) as well as 5-10 student curatorial assistants. In addition to being used for research, teaching, and public outreach, the collections form the core of hands-on learning in biodiversity science for students in the MVZ Undergraduate Program. By protecting the specimens through rehousing to ensure continued use, the project will benefit researchers globally, UC Berkeley students who work in the MVZ or take the Ornithology class with “Birds of the World” lab sections, and campus, local, or regional groups who visit the MVZ for tours and other outreach events.

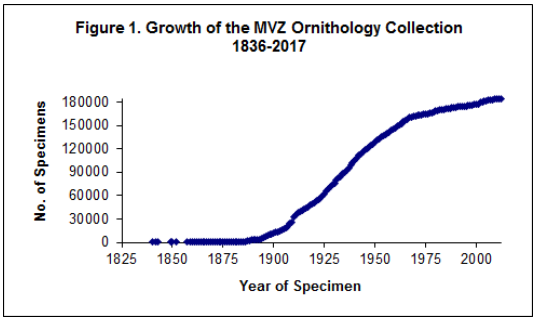
Stewardship of the Ornithology Collection of the Museum of Vertebrate Zoology

1. PROJECT JUSTIFICATION

We request support to address a high priority need in the Ornithology collection of the Museum of Vertebrate Zoology (MVZ), University of California, Berkeley. The MVZ houses one of the largest collections of terrestrial vertebrates in the United States, and is a center for scientific research and education. All collections operate as a single research unit, and the museum Director, faculty, and staff work together to identify collection and funding priorities that are beyond the scope of our annual budget.

This grant will allow the MVZ to accomplish a major goal for stewardship of its collections by addressing long-term housing needs, and thereby providing urgent pest protection, for one of the most important, but currently vulnerable, bird collections in the United States.

Strategic Plan for Upgrading the MVZ Ornithology Collection



One of the six components of MVZ's Strategic Plan (Strategicplan.pdf) is stewardship of the collections. Over the past 10 years, our highest priority has been to rehouse the Ornithology collection to provide better protection of bird specimens against pests. In doing so, we also have paid special attention to efficiently adding expansion space for new specimens. The MVZ is located on the third floor of the UC Berkeley Valley Life Sciences Building, and we cannot use compactors because of floor loading. Thus, we must rely on our existing case footprint for collection growth (Fig. 1).

In 2007, PIs Cicero and Bowie received a grant from the National Science Foundation's program "Collections in Support of Biological Research" (NSF CSBR, DBI-0646475) to digitize its analog audio recordings, rehouse its egg/nest collection (7% of the total MVZ bird specimens), digitally photograph the egg/nest specimens, and scan the original egg/nest data slips. All digital files are available online through the MVZ's collection database Arctos (https://arctosdb.org). Subsequently, PIs Cicero and Bowie received a second NSF CSBR grant in 2016 (DBI-1561515) to purchase 154 new cases to rehouse the passerine bird skins. That grant, which provided new cases for 35% of the skin collection, focused on passerine skins because they comprise the bulk of thpene MVZ Ornithology collection (~82%, not including eggs and nests, which are cataloged separately and have been largely rehoused). Furthermore, skins are most vulnerable to pests, and the new cases provided needed expansion space in the most actively growing part of the collection. Although the skeleton collection also needs rehousing and is actively growing, it comprises a smaller (10%) part of the collection and skeletons are less vulnerable than skins to insect damage.

As part of the rehousing, we have been reorganizing the collection to incorporate recent well-supported taxonomic changes and to accommodate growth. The classification of modern birds has undergone many changes in recent years (e.g., Prum 2015), and a disconnect with the MVZ Ornithology collection has created challenges for visiting researchers and for teaching the UC Berkeley Ornithology course (taught by Bowie) that relies heavily on the collection for its laboratory section. Physical changes to how the collection is arranged, along with updated Arctos database records, already have improved discoverability for teaching and research. We expect that taxonomic updating of the collection (following the American Ornithological Society and Clements checklists) will be complete by June 2019. We will continue to work on updating the collection as new checklist revisions are made available, as part of our routine curatorial activities. Supportingdoc1.pdf shows the collection layout with updated taxonomy.

Another stewardship goal is to replace existing wooden trays, which have wood or cardboard bottoms, with aluminum trays. Our old and new cases fit both wooden and aluminum trays interchangeably. A portion of the Ornithology collection already uses aluminum trays that were purchased at the time of cases to accommodate expansion. However, the majority of cases have older trays that are problematic for several reasons. First, the wooden trays are bad for specimens because of the potential for off-gassing and acid migration. Second, wooden trays are more prone to pest infestation. Third, the tray bottoms are variably thick and thus trays must have greater spacing in cases in order to avoid catching on specimens in the tray below; consequently, fewer trays fit in each case and cases are not being used most efficiently, resulting in less expansion space (Fig. 2). Finally, the cardboard bottoms of trays are especially problematic for skeletons because the heavy boxes result in bowing of the tray bottom, also requiring greater spacing of trays (Fig. 2). By replacing wooden trays with aluminum ones, we would eliminate these issues while also improving expansion space in our limited footprint by allowing us to place trays more closely together.

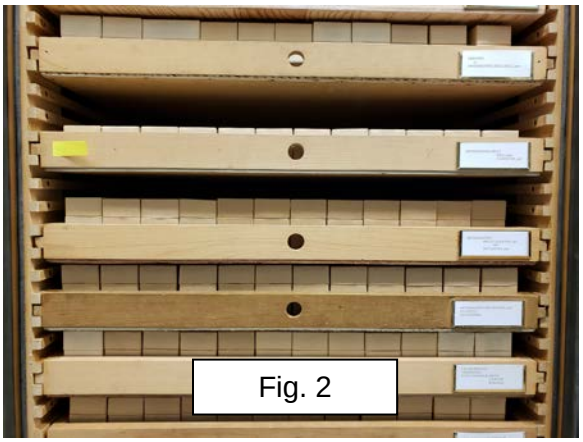


Fig. 2

Integrated Pest Management in the MVZ

Rehousing the Ornithology collection from cases in poor condition (Fig. 3) to new metal cabinets with aluminum trays is just one part of our strategic stewardship plan. Equally important is an Integrated Pest Management (IPM) Program that closely monitors the collections for pests. The MVZ had an Odd Beetle (*Thylodrias contractus*) outbreak in one of its side collection rooms in 2008, which affected the unique Milton Hildebrand collection and also threatened uncatalogued bird and mammal specimens that were collected during the Grinnell Resurvey Project (a museum-wide project started in 2003 to resurvey terrestrial vertebrates at historic localities in California). To address the problem, we hired a museum pest expert consultant from Insects Limited to provide recommendations. As part of the outcome from this work, we used MVZ funds to hire a recent UC Berkeley graduate for one year (2008-2009) to help with the pest infestation and develop best practices for non-chemical pest management. An important result of this project was the development of an IPM manual tailored for the MVZ, which we continue to follow today. This manual is posted on our website (http://mvz.berkeley.edu/MVZ_Basics.html) as part of the MVZ Handbook. Students are recruited through the UC Berkeley Undergraduate Research Apprentice Program (URAP) to assist with pest management, including checking every case for signs of pests and monitoring sticky traps. This is a valuable learning experience for students because they learn to identify pests and signs of activity while also becoming familiar with the entire MVZ Ornithology collection and the diversity of birds that we house and curate.

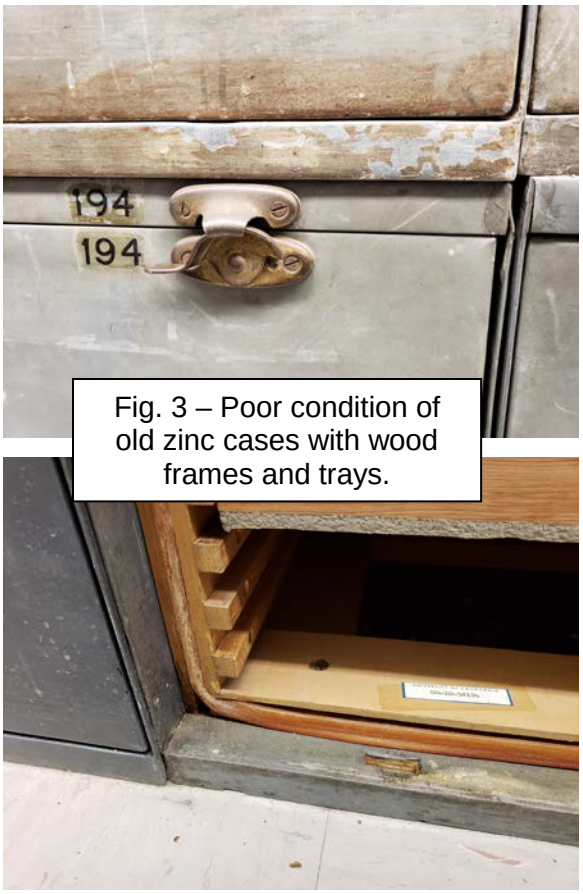


Fig. 3 – Poor condition of old zinc cases with wood frames and trays.

Urgent Need for Rehousing the MVZ Ornithology Collection

Prior to 2017, the MVZ had 442 cases housing its bird skins, of which 377 (85%) dated to the early 1900s. The other 65 cases (15%) were more modern Delta Designs cases that were purchased when the museum moved into the renovated Valley Life Sciences Building on the UC Berkeley campus in 1993. The older "MVZ-style" cases, many of which are in poor condition (Fig. 3), are made of an oxidized zinc alloy surrounding a wooden frame, with a removable door that latches on top. This design was intentionally light-weight, but has proved vulnerable over time. Three major issues (Fig. 3) are: (1) loss of a continuous tight seal around the case because of damaged latches, inadequate sealing with rubber gaskets due to wear, and enlargement of the bottom grooves by which the doors attach after decades of use; (2) warping of bottom cases caused by years of double-stacking, which has further weakened door seals, caused gaps between the sides and doors, and created problems with the fit of doors (some cases are impossible to open now); and (3) the internal wooden frame, which can attract pests. The zinc frames of some cases also have holes or other signs of outer damage. The old, weakened condition of our cases increases the vulnerability of specimens to insect infestation. We have battled several pest outbreaks (odd beetles, drugstore beetles) in recent years, and monitor the collection closely as part of our Integrated Pest Management program.

Fig. 4 – New cases (left) and old cases (right).

To address these issues, the MVZ has been replacing its Ornithology cases in phases (Fig. 4). This is necessitated by budgetary constraints, both internally and through external funding sources, which make it prohibitively expensive to replace all older cases at once. The 154 cases purchased in 2017 on NSF funds were used to rehouse passerine bird skins, and provided protection for an additional 35% of the collection. It also allowed us to add cases for expansion of passerine skins. Additional funding provided by IMLS through this proposal will enable us to continue strategically rehousing the MVZ Ornithology skin collection by purchasing another 74 new cases for non-passerine skins. These additional cases will allow us to complete the rehousing along one major area of the collection (Supportingdoc1.pdf) with room for expansion, and will result in 67% of the bird skins being stored in new cases. It also will allow us to replace a large number of older wooden trays with modern aluminum trays, which are superior from the standpoint of pest protection, weight loading, and spacing. We plan to seek additional external funds in the future to complete rehousing of the remaining 33% of the collection.

Impact of the Project

The MVZ Ornithology collection is heavily used for research through loans, visitors, and online access to data (Tables 1-2). Studies that use our skins include analysis of phenotypic traits, destructive sampling of specimens for molecular analyses, and sampling of feathers for isotopic or pigment characterization. In addition, skins form the core of "Birds of the World" labs used to teach Ornithology, and they are used regularly for tours and other outreach events such as Cal Day (the University's annual open house during which the MVZ receives over 2,500 visitors). Rehousing of the skin collection into new cases is vital for its protection from potential pest damage to ensure continued use.

Table 1. MVZ bird loans, collection visitors, and data usage over the past 5 years.

Fiscal Year	No. Loans / Specimens[1]	No. Visitors / Visitor-Days[2]	No. Queries / Records Accessed[3]
2013-2014	34 / 303	40 / 166	150,940 / 26.1M
2014-2015	39 / 1105	95 / 111	24,318 / 4.1M
2015-2016	34 / 1892	60 / 90	38,211 / 5.7M
2016-2017	33 / 992	74 / 100	34,246 / 9.1M
2017-2018	43 / 1244	30 / 46	27,796 / 12.7M

[1] Loans of skins, skeletons, and tissues. Does not include eggs, which are not loaned, nor returns of loans. Fiscal Year: July 1 – June 30.
[2] Research visits to the collections. Excludes organized tours or outreach events.
[3] Queries to MVZ Ornithology collection data in Arctos (https://arctosdb.org). Data are also are served to external aggregators including VertNet (http://vertnet.org), iDigBio (https://www.idigbio.org), and the Global Biodiversity Information Facility (GBIF, https://www.gbif.org); does not include these portal statistics. Reduction in Arctos numbers starting in 2014-2015 likely reflect changes in Arctos traffic monitoring (e.g., improved security) and the availability of other portals for searching Arctos data.

Table 2. Examples of 5 recent publications that used MVZ Ornithology skins.

Berns, C. and D. Adams. 2013. **Becoming different but staying alike: Patterns of sexual size and shape dimorphism in bills of hummingbirds.** *Evolutionary Biology* 40:246-260.
Billerman, S. M., M. A. Murphy, and M. D. Carling. 2016. **Changing climate mediates sapsucker (Aves: *Sphyrapicus*) hybrid zone movement**. *Ecology and Evolution* 6:7976-7990.
Mason, N. A., A. J. Shultz, and K. J. Burns. 2014. **Elaborate visual and acoustic signals evolve independently in a large, phenotypically diverse radiation of songbirds**. Proceedings of the Royal Society B 281: 20140967.
Rohwer, S. and K. Broms. 2012. **Use of feather loss intervals to estimate molt duration and to sample feather vein at equal time intervals through the primary replacement.** *Auk* 129:653-659.
Vo, A. E., M. S. Bank, J. P. Shine, and S. V. Edwards. 2011. **Temporal increase in organic mercury in an endangered pelagic seabird assessed by century-old museum specimens.** *Proceedings of the National Academy of Sciences USA* 108:7466-7471.

2. PROJECT WORK PLAN

We plan to purchase 74 new cases for non-passerine skins in the MVZ Ornithology collection. As noted above, we must replace our cases in phases because of budgetary constraints. With the rehousing of our passerine bird skins (completed in 2018) in 154 new cases purchased on our NSF CSBR grant, 50% of the MVZ Ornithology skin collection is now housed in modern cases that protect the specimens from potential pest damage. Replacing the remaining 223 cases housing MVZ bird skins is our highest priority, but this would cost more than is allowed by the IMLS program given the cost of the cases, our need for aluminum trays, and our need to budget for personnel to help with rehousing. Therefore, we will focus this phase of our strategic upgrade on two banks of non-passerine skin cases in order to

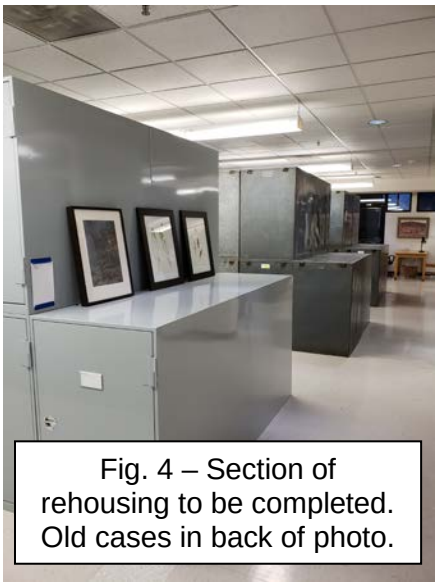


Fig. 4 – Section of rehousing to be completed. Old cases in back of photo.

complete rehousing along an entire, heavily used section of the collection (Fig. 4, Supportingdoc1.pdf). These cases house primarily penguins, loons, gulls, alcids, and hawks. By focusing on this section of the collection, we also will be able to add space for new acquisitions of larger-bodied birds (e.g., ongoing donations of seabirds, hawks, and other species shot at Oakland and San Francisco airports as part of their control programs; seabirds killed by oil spills or other causes off the coast of California). From recent experience with our CSBR grant, 74 cases is about the maximum that can fit in our library when used as a staging area (see below).

In addition to new cases, we plan to purchase 400 aluminum trays as part of our upgrade to the collection. These trays are interchangeable with existing cases and trays in the collection, but have multiple advantages from the standpoint of pest protection, weight loading, and spacing. In addition, they are needed to accommodate expansion of the collection. Aluminum trays will be used to replace wooden trays in areas of the collection where they are most needed, e.g., in skins and skeletons where existing trays require wider spacing in order to avoid catching on the specimens below, thus accommodating fewer trays per case. For both skins and skeletons, we need to maximize the number of trays that can fit in each case in order to accommodate growth. This is necessary because expansion space is limited to our current footprint, i.e., we can't use compactors because of floor loading constraints. The problem is especially acute in the skeletons, where cardboard bottom trays are bowed due to the weight of boxes. Skeletons are a growing part of the collection (an average of 150 avian skeletal parts cataloged annually over the past 10 years, many of which are large-bodied birds), and we are actively focused on preparing skeletons to expand the collection and provide training for undergraduates in our popular class Prep Lab Class. We expect that we can fit 1-2 extra trays per full case when using aluminum versus wooden trays.

We will purchase the new cases and trays from Delta Designs (see Budget Justification, Supportingdoc2.pdf) at the start of the grant to replace our existing zinc cabinets. Because we cannot use compactors due to floor loading, the new cases will be installed in our existing case footprint. If we receive an award starting October 2019, we will immediately request a purchase order (PO) for Delta Designs which already exists as a vendor in the UC Berkeley system. We have recently purchased two large sets of cases from them, and expect that the PO can be processed quickly. The President of Delta Designs has assured us that they can manufacture the cases for delivery by January 2020.

Our old cases must be moved to another space prior to delivery of the new cases, so that the new cases can be delivered directly to where they will be installed. From our experience with moving old cases to make room for the 154 new cases purchased on our NSF CSBR grant, the MVZ Grinnell-Miller Library works well as a staging area. However, the library is used weekly for seminars and lab meetings during the academic semesters. Therefore, we cannot start moving old cases into the library until the last weekly "MVZ Lunch" seminar in late November. We estimate that it will take approximately two weeks full-time to move cases into the library, with help from a postbac and two undergraduates (see Budget Justification). The cases will be delivered in early January, and can be installed in one day due to Delta Design's efficient crew who is already familiar with our space. It will take another two weeks to move specimens from the old to new cases and dispose of the old cases. We need to complete this task prior to the start of spring semester 2020, and are confident that we can accomplish it during this short period because of recent past experience. We purchased the last set of 154 cases in two batches of 78 and 76 cases, and were able to move and rehouse specimens for the second set of cases from late November 2018 to mid-January 2018.

In order to expedite the move and subsequent disposal of old cases, which is needed to make our library functional again, we will move specimens from old to new cases in their existing drawers. Once we have finished that task and disposed of the old cases, we will move specimens from old wooden to new aluminum trays. We will install new acquisitions of large-bodied birds in the process, and will strategically leave room for expansion. We also will create new labels for the cases and drawers. We expect this work, which will be done by a postbac and undergraduate, to be completed in summer 2020.

All cases are placed directly on tiles on the floor. As we move the old cases, it is inevitable (from our recent experience with moving cases of passerine skins) that floor tiles will come loose or break. This is because years of waxing the floor has caused old cases to become stuck, thus requiring that we pry them loose. Prior to installation of the new cases, we will replace any loose or broken floor tiles at the museum's expense (cost share).

We will recruit the postbaccalaureate and two undergraduates at the start of the project to assist with moving old cases, rehousing specimens in new cases, and moving specimens from old wooden to new aluminum trays. The MVZ has over 100 undergraduates or postbaccalaureates who work in the museum every semester, and thus we have a large pool of students to recruit from. The postbac and students will be recruited from those already familiar with MVZ curatorial activities, and we will provide training at the start of the project to make sure that specimens are moved in an orderly and careful fashion – paying special attention to our recently updated taxonomic organization and to areas of the collection in greatest need for expansion space. We will work closely with the postbac and students at the start, when cases are being moved and specimens are rehoused. Subsequently, we will supervise the postbac and undergraduate in the replacement of old wooden with new aluminum trays, and will direct them to areas of the collection that could benefit most from new trays. We will check in with them weekly as they conduct this task and as they re-label the trays and cases.

Summary of major project activities:

1. Move specimens from old zinc cases to 74 new cases
2. Move specimens from old wooden trays to new aluminum trays
3. Relabel cases and trays

Roles of key project personnel:

Carla Cicero, Staff Curator (30% FTE, cost share) will oversee the project including budget and reporting. She will purchase the cases and drawers, oversee their delivery and installation, and supervise the postbac and undergraduates.

Rauri Bowie, Faculty Curator (25% FTE, cost share) will jointly oversee the project and help with reporting.

Michael Nachman, MVZ Director (10% FTE, cost share) will assist with logistical issues including coordinating the staging of cases in the MVZ library so that it doesn't interfere with other MVZ activities (e.g., lab group meetings, seminars). In addition, he will serve as the administrative liaison for the campus, including with the offices of Purchasing, Facilities Services, and Property Management.

Students will help carry out the key tasks for this project. A **postbaccalaureate (grant funds)** and two **undergraduates (cost share)** will rehouse specimens in new cases, move specimens from old wooden to new aluminum trays, and relabel cases and drawers. Undergraduates will be recruited

through the MVZ's award-winning Undergraduate Program (Hiller et al. 2017), which partners closely with the UC Berkeley Undergraduate Research Apprentice (URAP) program.

3. PROJECT RESULTS

Strategic Stewardship

Care of the MVZ Ornithology collection will be improved substantially as a result of this project. By protecting the specimens through rehousing in new cases, and by replacing a substantial number of old wooden drawers with new aluminum ones, the MVZ will ensure that this collection will grow and be available for research, teaching, and outreach in years to come. The proposed activities further the overall MVZ mission and strategic plan, which is to maximize stewardship and access for its collections.

Evaluation of the Project

Cicero, Bowie, and Nachman will evaluate project activities and oversee student work to ensure that the targeted rehousing and move to new trays remains on schedule, is conducted in a careful and orderly manner, and is completed with minimal impact to the community.

Tangible Products

This project has two tangible products: (1) rehousing a major section of bird skins in 74 new cases, which will bring urgent pest protection (along with ongoing Integrated Pest Management activities) to 67% of the total skin collection; (2) replacement of 400 old wooden trays with new aluminum trays which provide better pest protection and allow more drawers per case for most efficient storage.

Public Awareness and Communication

The MVZ community will be kept abreast of grant activities, especially the logistics of moving cases and rehousing specimens as they impact regular museum activities (e.g., lab meetings, seminars). Visiting researchers will be informed of the rehousing activity. Announcements will be posted on the MVZ website, in its newsletter, and on social media.

Project Sustainability

The MVZ is committed to long-term stewardship of its collections through proper housing and dedicated support. The MVZ Ornithology collection has two full-time curators (Cicero and Bowie) as well as 5-10 student curatorial assistants. In addition to being used for research, teaching, and public outreach, the collections form the core of hands-on learning in biodiversity science for students in the MVZ Undergraduate Program (Hiller et al. in press). The MVZ has a 110-year history of caring for and growing its collections, and protecting these collections for future use is the museum's highest priority.

References:

Hiller, A. E., C. Cicero, M. J. Albe, T. L. W. Barclay, C. L. Spencer, M. S. Koo, R. C. K. Bowie, and E. A. Lacey. 2017. Mutualism in museums: A model for engaging undergraduates in biodiversity science. PLOS Biology 15(11): e2003318.

Prum, R. O., J. S. Berv, A. Dornburg, D. J. Field, J. P. Townsend, E. M. Lemmon, and A. R. Lemmon. 2015. A comprehensive phylogeny of birds (Aves) using targeted next-generation DNA sequencing. Nature 526:569-573.

Schedule of completion for proposed project activities
1 October 2019 – 30 September 2020

	Oct 2019	Nov 2019	Dec 2019	Jan 2020	Feb 2020	Mar 2020	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2019	Sep 2019
Grant starts												
Order cases												
Hire students												
Move old cases												
Deliver cases												
Rehouse skins												
Dispose old cases												
Replace trays												
Grant wrap-up												