

FRIENDS OF THE PHILIP L. WRIGHT ZOOLOGICAL MUSEUM

FALL 2021 (No. 38)

FROM THE CURATOR

It's been six months full of variety around the museum, with equal parts teaching, research, and outreach!

On the teaching front, **Jed Brodie** and I co-taught Mammalogy, with Jed tackling lectures and me tackling lab activities. I ended up restructuring almost every aspect of the labs, trying to focus more on functional knowledge and skills rather than rote memorization. I added field trips to the course (one highlight: a mink diving for food!) and several entirely new labs focused on behavior, specimen prep, internal anatomy, and mammalian diseases and parasites, with special guest **Mike Kinsella**. What a treat to spend a day searching for helminths with our own Missoula-based world expert in the field! Our work on the research and outreach fronts revolved around two big projects—our Marmot Madness citizen science work, and our bird art show at MMAC, both of which are detailed in this newsletter.

Last but not least, we worked with the UM Experiential Learning and Career Success office to establish long-term funding for our **Graslie Curiosity Intern program**, which will support two interns in the UMZM each spring semester going forward! This stability brings alum and science educator **Emily Graslie's** vision fully to life, recognizing and rewarding student work in the UMZM and helping to make more viable opportunities for students who are supporting themselves financially while in school.



Angela Hornsby, Ph.D., UMZM Curator



ABOVE: Emperor penguin (*Aptenodytes forsteri*) specimens in our research collections.



LEFT: Soon Raccoon, at right, sneaks into a shot during filming for *The Brain Scoop* with Emily Graslie (photo by John Weinstein for The Field Museum).

BELOW: Soon at home in our colorful Health Sciences Building display case, completed with help from Lisa Bickell (Field to Frame).



OUTREACH

WELCOME BACK, SOON!

We recently welcomed home a familiar face—**"Soon" Raccoon!** Curator Angela Hornsby dropped by The Field Museum in Chicago this summer to pick up Soon, the live-mount raccoon that had been on loan as a mascot for years as part of **Emily Graslie's** science communication series, *The Brain Scoop*. With Emily's tenure at the Field coming to an end, it was time for Soon to return to the UMZM, where it can currently be seen in our 1st floor Health Sciences hallway display case. Welcome back to perhaps the world's preeminent taxidermied procyonid!

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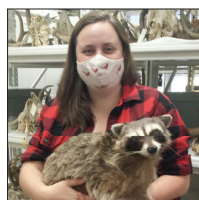
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SPECIMENS IN FLIGHT

Erin Keller
OBEE M.S. student, Tobalske Lab
UMZM Graduate Curatorial Assistant

When we consider organisms living their lives and moving about their environment, we can forget that basic locomotion is an important aspect of their ecology. Navigating one's life requires various physiological and biomechanical adaptations: a seal that swims gracefully in water must waddle and flop on land; a mountain goat moving between ranges needs to navigate rocky inclines and tricky footing to make the trip safely. But what happens when the substrate itself varies dramatically as an organism is experiencing it? The individual must be ready to adjust, or else face energetic costs or bodily harm.

As humans, we tend to think of the aerial environment as rather static or moving in large, prevailing wind patterns. In reality, it's more accurate to imagine the aeroscape as a **constantly changing, sometimes unpredictable jungle gym that's a few miles thick**. Our current understanding is that these dynamic conditions are as invisible to flying species as they are to us. **How, then, do birds deal with turbulence and mitigate disturbances in flight?** Their strategies can be divided into two types. Active strategies involve muscular contractions, like flapping wings asymmetrically to balance uneven gusts. And passive strategies rely on pre-existing forces around the body and wings to dampen disturbances; for example, turkey vultures holding their wings in a deep V to counteract crosswinds.

Large birds of prey provide an interesting opportunity to study these strategies because they use both powered, flapping flight and soaring and riding air currents long distances. They also have a prominent structure that has captured the attention of biomechanists and engineers for years: **emarginate primary feathers**, the noticeable "finger feathers" to birders (Fig. 1). The shape of these feathers makes them very flexible, in theory allowing some turbulence dampening during flight.

To investigate this possibility, I have been using UMZM specimens to analyze the forces around emarginate primary feathers. Not only do birds that meet an early demise find a second life through museum collections, but some even come to fly once again! Students from the Carcass Club helped prepare spread wings from salvaged raptors such as ospreys, pinning and drying the wings fully extended to accentuate the spread of the primaries (Fig. 1).

Figure 1 | An osprey wing pinned to dry in an extended position, with the emarginate primary feathers spread individually.



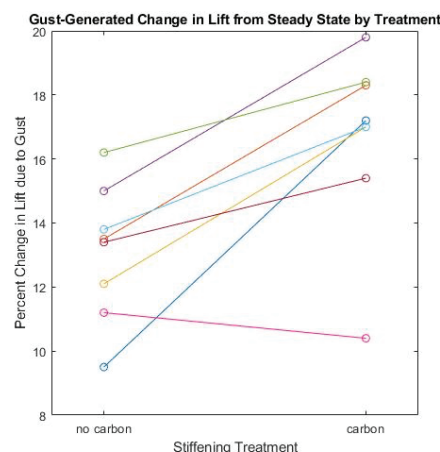
Figure 2 | A wing mounted in the wind tunnel at a gliding speed of 10 meters per second. At the top of the photos, the motor-controlled airfoils are visible, which generate upward gusts when activated. White dots along the primary feathers allow for tracking of bend, twist, and flexion by high-speed cameras.



At the UM Flight Lab, these wings take to the air in one of our wind tunnels (Fig. 2). Using force plates, high-speed cameras, and a gust generator, we can collect small changes in aerodynamic forces around the wings as well as 3D changes in bend, twist, and flexion of each feather. We collected data from each wing at steady gliding speeds and with the introduction of an upward gusts, before and after artificially stiffening the primary feathers using carbon fiber rods along the rachis (the stiff center of the feather).

While the stiffened wings had lower lift than unstiffened wings at steady gliding speed, there was no statistical difference in the amount of lift produced by the gust. However, because the unstiffened wings were already producing more lift than stiffened at steady speed, we found that **a gust of the same magnitude was proportionally less disturbing in flight to unstiffened wings** (Fig. 3). In the 3D feather data, stiffening predictably reduced feather bending and flexion during steady air flow, but it did not affect the amount of bend, flexion, or twist seen during an upward gust.

Figure 3 | Wings in an upward gust experience a greater percent change in lift from steady flow when emarginate primaries were stiffened than -in their unstiffened state (n=9, p=0.006).



Together, this suggests that the **inherent arrangement of the primary feathers, and not the bending of feathers in response to perturbation, is what dampens disturbance during an upward gust**. This passive action of emarginate feathers in flight is another piece of the puzzle to understanding how birds navigate their aerial environment. My hope is that expanding our knowledge of flight mechanics will help to make aeronautic technology safer, but will also help bring more appreciation to the complexity of life for birds on the wing. Aeroecology is a new and expanding field, and it will take curious minds to push the boundaries of our understanding of an entire environment above our heads every day. We only need to stop and look up.

2021 MARMOT MADNESS REPORT

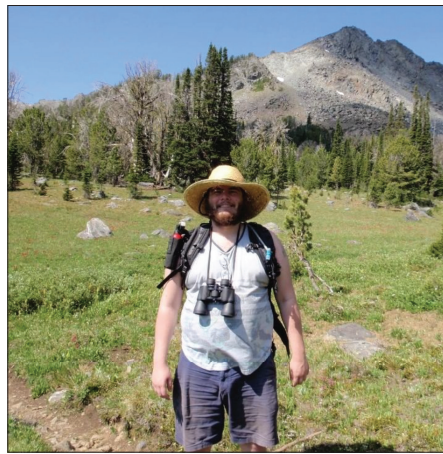
The first field season of our marmot project is in the bag, with mixed results! We certainly collected some good data and got a sense of some of the challenges we'll need to tackle as we go forward, but the summer was ultimately cut off at the knees by the difficult fire season.

The goal in 2021 was to get us off the ground on some hoary marmot (*Marmota caligata*) work, which was originally suggested by Phil Wright's son, **Alden Wright**. Alden recalled family trips collecting marmots for the museum, and for some decades he has carried his father's curiosity about how isolated hoary marmots are on the mountaintops and ridges here at the southern edge of their range, especially as the climate continues to warm. After talking with **Link Olson**, a marmot expert at U of Alaska-Fairbanks, we decided to start off by just trying to **figure out whether hoary marmots are still found in the places they were historically (40+ years ago) collected or observed.**

This summer, we attempted to resurvey as many of the 40 historical hoary marmot sites (most of which are from UMZM specimens!) as possible. With Alden's help, we teamed up with volunteers through the Rocky Mountaineers and reached out to other mountain and nature groups. Knowing that climbing up a mountain to look for oversized rodents wouldn't be everyone's cup of tea, **we were really pleased by the amount of interest we received: about 2/3 of our sites were reserved by 19 potential surveyors.** However, with the onset of smoke on Independence Day, western Montana air quality ranged from "moderate" to "unhealthy" for all but five days during what should have been our peak survey period (to say nothing of the road closures that kept us out of some areas, regardless). Ultimately, our whole citizen science team was able to complete just 13 surveys this year. While we wanted to do more, that's just the reality of field work. Even for some sites that weren't completed, we now have updated information about vegetation, recent fire activity, and road conditions to better plan trips to those sites in the future.

What's next for Marmot Madness? The short answer is, another field season to hit all the points we had hoped to visit in 2021! The long answer is that we'll likely continue these surveys for several seasons, for a few reasons:

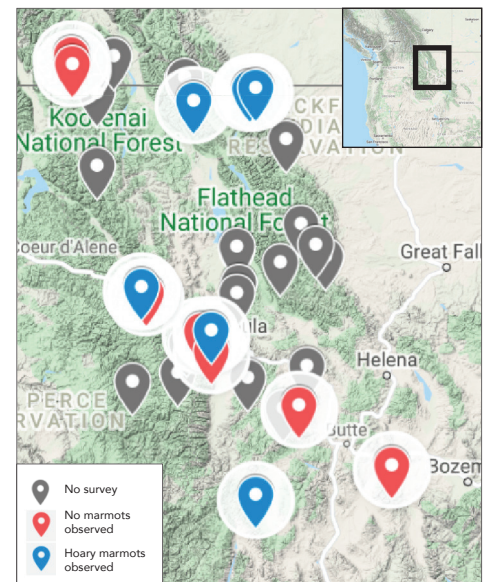
- (1) First and most fundamentally, **any and all data we can collect on marmot occupancy is helpful during this important period of climate change**, wherein cold-adapted, montane species like hoary marmots are most likely to start disappearing from marginal areas of their ranges.
- (2) Second, the more resurveys we can conduct at the same locations—and **reporting both presence and absence of marmots**—the better our understanding of the detectability of this species across habitats, dates, weather patterns, and varying survey efforts. That will allow us to quantify the amount of work needed to confidently say whether marmots have disappeared from a given site, a simple but critical piece of information as we assess the potential effects of environmental change.
- (3) Third and most excitingly, we'd like to eventually expand this project into some larger genomic and biogeographic work. These surveys will not only uncover the status of hoary marmots in this region for context, but will also show us the best places to go for future collections or DNA sampling.



ABOVE: Summer intern Dennin Holmes-Mora en route to a marmot survey site in late June.



ABOVE: A bald eagle soars above a survey site in late August... fun to see, but not ideal for spotting marmots!



ABOVE: Hoary marmot occupancy based on the 2021 field season and other recent observational data. Six sites (blue) had hoary marmots, seven sites (red) were surveyed but had either yellow-bellied or no marmots, and 28 sites were not completed within the season.

OUR SURVEY TEAM

We know it was a difficult summer to be out looking for marmots, but we're still thankful for everyone who signed up for surveys even if they weren't able to complete them—thanks to **Jim Semmelroth, Becka & Steve Barkley, Maci MacPherson, Tom Statz & Elizabeth Moore, Michelle Barton, Vick Applegate, Cory Cleveland & Rebecca Rawlinson, Reg Spannaus, Colby Anton, T.J. Clark & Kyra Wolf, Dan Gibson, Phil Wright Jr., Alden Wright** for generously funding this project, and field intern **Dennin Holmes-Mora** for his help planning all the surveys and executing those that we could!

Whether you do an official Marmot Madness survey or not, you can always contribute data by loading your marmot sightings to iNaturalist!





ABOVE: A view of the *Avis marvelous* exhibition, open now at the MMAC on campus. Over 60 UMZM specimens are featured in the show, including some of our oldest mounts.

OUTREACH

AVIS MARVELOUS

In September, our show *Avis marvelous: Ornithology in 19th Century Art and Science* opened at the Montana Museum of Art and Culture on campus. Exploring our scientific and artistic understanding of North American bird life from the late 1700s to early 1900s, this show developed as a collaboration between the UMZM, the MMAC under director **Rafael Chacón**, and retired educator and collector **Lee Silliman**.

Our summer Graslie Curiosity Intern **Spencer Kim** worked closely with MMAC intern **Shannon Webb** to set the themes, choose the art and specimens, design the layout, and write much of the interpretive signage—and UMZM interns and volunteers spent untold hours cleaning and preening our specimens and mounts to make them shine.

This wonderful little exhibition is open to the public through **Jan 8, 2022**. Check the MMAC website for details, and plan to stop by if you haven't yet!



ABOVE: Behind the scenes as students Spencer Kim (UMZM, Graslie Curiosity Intern) and Shannon Webb (MMAC) wait to cart specimens and supplies into the gallery during installation.



LEFT: Specimens and prints from the "Forest Birds" section of the exhibition, from calliope hummingbirds, to woodpeckers, to turkeys.

BOTTOM LEFT: A Ross's Goose flies over the "Water Birds" section. While we selected prints and specimens mostly from birds found in western North America, we included a few extraordinary species (such as the collection of bird head mounts from Bart O'Gara).

BOTTOM RIGHT: UMZM Curator Angela Hornsby talks with collector Lee Silliman.



FACILITY FEATURE

We wrapped up a big ongoing project this fall: renovating our display cases on the 5th floor of the Mansfield Library. For the last year, UM undergraduate student **Sydney Driver** led the redesign of five display cases—with all the themes, coordinating signs, tags, text, and imagery—first as an independent study student and then as a dedicated volunteer while she wrapped up her degree.

There are many highlights in these display cases, including a small painting by Mary Elrod (circa early 1900s), a vignette featuring some tools of the trade in field biology and specimen preparation, and a diversity of shells and corals donated by **Jack Berman**. Stop by to see Sydney's handiwork any time the Mansfield Library is open!



ABOVE: A shelf of shells is interesting from all angles in a glass display case.

BACKROOM NOTES

This fall, we renewed our display contract with **Fort Benton Museum**, which houses the historic Hornaday bison mounts. This group of six bison was collected by William T. Hornaday from one of the last wild herds in North America, as he feared the species would soon go extinct. It's not a tactic we would take in modern conservation, but it was ultimately successful as it helped to drum up support for conserving this iconic species. These mounts were first displayed at the Smithsonian Museum of Natural History in 1887, during which time the large bull became the model for bison imagery on currency and stamps, the seal of the Department of the Interior, and the National Park Service badge.

When the Smithsonian decided to renovate their displays in the 1950s, UM acquired the mounts with the intent to display them on campus. Unfortunately, that vision was never realized, and the mounts were instead separated, held in storage, and more or less forgotten about until a dedicated group tracked them down and had them restored and moved to Fort Benton in 1996—you can read the interesting account of this in the book *Reflecting the Sublime: The Rebirth of an American Icon* by author and naturalist **Douglas Coffman**. Visitors can continue to see these iconic mounts and learn about the history of bison in the American West in the dedicated showroom at Fort Benton. Thanks to curator **Dave Parchen** for working with us on the new contract, and for ensuring the good care and display of these mounts with so much history attached.



ABOVE: Sydney Driver puts the finishing touches on one of her display cases, with a theme of Montana State Symbols. BELOW: The main interpretive cabinet explaining the history and function of the UMZM.



ABOVE: Group of six Hornaday bison on display at the Fort Benton Museum (photo by Sharalee Smith).

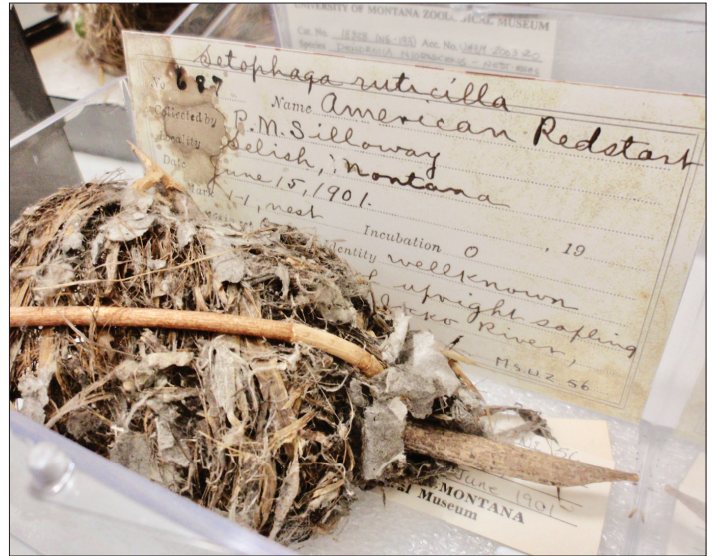
WHO'S IN THE MUSEUM

GRAD STUDENTS: **Hila Chase** has been cleaning off bird humeri in the beetle box for use in research and the Comparative Anatomy class, **Erin Keller** continued to assist in Carcass Club each Friday, **Ryan Mahar** began *Peromyscus* skinning for his research on thermal conductance of the skin and pelage, **Taylor Gold-Quiros** necropsied fish for her project on heavy metal contamination and nutrient enrichment, and **Cynthia Ulbing** prepped her first ever mammal specimen. From Anthropology, **Haley O'Brien** used the collections for her research on bone cortical structure, and **Holli McDonald** worked to clean and update the database condition notes of our ungulate skulls and skeletons.

UNDERGRAD INTERNS: Over the summer, Graslie Curiosity Intern **Spencer Kim** helped to plan and assemble the beautiful *Avis marvelous* show, and field technician **Dennin Holmes-Mora** assisted in the hoary marmot survey project. **Matthew Rensvold** filled wildlife experiential hours on a variety of tasks.

UNDERGRAD VOLUNTEERS: **Sydney Driver** completed her updates to our display cases in the Mansfield Library—a nice treat for anyone up on the 5th floor! Our Carcass Club specimen prep group keeps churning out specimens, with **Madeline Kleeman**, **Dennin Holmes-Mora**, **Addy Flegel**, and **Kelsey Miller** all helping out, while **Marissa Italiano** continued to specialize on cataloging, numbering, filing, and other curatorial tasks.

FRIENDS & VISITORS: Our volunteer extraordinaire **Samantha Getty** graduated in spring 2021, but she has continued to come in regularly and has become an integral part of the museum's functions. We talked taxidermist **Autumn Evans** into visiting, and she skinned out a large roadkill beaver. **Larry DePute** has continued working on bird skeleton articulations, and we keep finding great uses for them! **Mike Kinsella** joined **Kara Cromwell** to sort through Taylor's fish for parasites, and he also was an indispensable guide in our new diseases and parasites lab for Mammalogy class. Undergrads **Sarah Grenfell**, **Taylor Coon**, and **Abi Romero** (with postdoc **Rena Schweizer**) used our collections for their research, archaeologist **Weber Greiser** visited to ID bones, Bard College professor and UM alum **Bruce Robertson** photographed birds for his work on UV reflectance of feathers, **Solomon Ziegert** visited with reporters from *The Missoulian* to take photos of our bats, and the creative **Lisa Bickell** (Field to Frame) helped complete our 1st floor display in Health Sciences. We briefly hosted four artists-in-residence through OpenAIR Montana, including natural history illustrator **Madison Mayfield**, who took inspiration from our work and collections. We also had the joy of hosting **Sean Hill's** "research in creative writing" graduate class—one of our most deeply engaged groups in recent memory! In the last six months we welcomed over 140 people for general tours, rebounding a bit since the start of COVID.



ABOVE: An American redstart (*Setophaga ruticilla*) nest, collected in 1901 by ornithologist Perley Milton Silloway.



LEFT: A paradise tanager (*Tangara chilensis*) collected from Ecuador in 1961.

BELOW: Mike Kinsella helps Mammalogy class look for parasites in the guts of a beaver, striped skunk, least weasel, and two red squirrels.



CARCASS CLUB LEADERBOARD

Preparator	Tally	Known for
Samantha Getty	104	lives in the prep lab!
Dennin Holmes-Mora	22	large bird specialist
Erin Keller	21	bird wing mechanics
Madeline Kleeman	21	speed skinning
Addy Flegel	8	tag tying and turkeys
Kelsey Miller	5	helping where needed
Isabel Rickart	3	clean stitching
Max Greenleaf	3	bird skeletons
Autumn Evans	2	large rodent skills

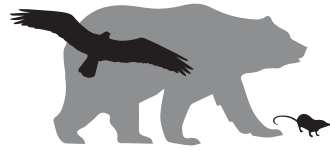


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OUR MISSION

The Philip L. Wright Zoological Museum, a unit of the Division of Biological Sciences of the University of Montana, is committed to the collection and preservation of zoological specimens for the purposes of research, education, and community outreach. We work for both current and future generations, sustaining these irreplaceable resources representing our natural heritage in Montana and beyond.



FRIENDS OF THE PHILIP L. WRIGHT ZOOLOGICAL MUSEUM

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