RAPTOR RESEARCH FOUNDATION

ANNUAL CONFERENCE
OCTOBER 17 - 21 2023
ALBUQUERQUE, NEW MEXICO

RRF 2023
Albuquerque

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Kidd Biological, Inc. is a certified women-owned small business (EDWOSB) that provides a wide variety of environmental consulting services to various industries. With our team of biologists, we provide creative and comprehensive strategies for balancing development with conservation by utilizing staff that are specialized in their field. We specialize in focused surveys and monitoring for all raptors found in California. Our team can also provide a wide variety of permitted activities. We also specialize in compliance monitoring following Biological Opinions and Decision Memorandums (CatEx's). We serve all of California and can assist with projects in Washington, Oregon, Nevada, Utah, and Arizona.

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Audubon protects birds and the places they need, today and tomorrow, using science, advocacy, education, and on-the-ground conservation. Audubon Southwest is the regional office of the National Audubon Society, covering Arizona and New Mexico. To protect birds and the places they need through the above strategic areas, Audubon Southwest engages in science, advocacy, education, and on-the-ground conservation. We choose these approaches because education builds more effective advocates, scientists, and conservationists; because science ensures that our education, advocacy, and conservation is accurate and beneficial; and because advocacy supports the investment and willpower that feeds into effective education, science, and conservation. Employing all of these tactics allows us to drive change effectively across multiple scales while benefiting birds and the places they need today and tomorrow.

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Leading researchers around the world rely on Lotek telemetry equipment and expertise. We are proud to be partners in fish and wildlife research being conducted in more than 100 countries – on every continent and in every ocean.

The mission of Hawk Mountain Sanctuary Association is to conserve birds of prey worldwide by providing leadership in raptor conservation science and education, and by maintaining Hawk Mountain Sanctuary as a model observation, research and education facility.

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HAWKS ALOFT

Hawks Aloft, Inc. is a 501(c)3 non-profit based in Albuquerque, New Mexico. Our mission is to preserve New Mexico's unique landscapes and wildlife populations for future generations by working to conserve indigenous wild birds and their habitats. We achieve our mission through avian research, conservation education, raptor rescue, and collaboration with other organizations.

RESEARCH: Long-term studies of all species of birds form the core of our program. These studies include nesting raptors, passerines (songbirds), and endangered species, provide data to understand population trends in birds, recreational impacts, and help form habitat management actions. Some of our study sites include: Valles Caldera National Preserve (owl communities/waterfowl/avian community response to wildfire and management), Rio Grande del Norte National Monument (raptor populations study), Middle Rio Grande Bosque (nesting raptors and avian population trends relative to climate change, recreation, and land management).

EDUCATION: Living with the Landscape is the centerpiece of our program, serving all students in grades K-5 at participating Title 1 elementary schools in the Albuquerque metro area free of charge. The year-long program includes multiple presentations for individual classes all featuring live, non-releasable birds of prey, as well as field trips for 4th and 5th grades and a student led conservation project.

RAPTOR RESCUE: We operate the statewide Raptor Rescue Hotline 24/7 and 365 days/year. The hotline fields 600+ calls and admits an average of 200 injured birds annually. We have two on-call veterinarians and work with other veterinary clinics and rehabilitation groups to ensure that injured and orphaned raptors, corvids, roadrunners and more receive treatment.

COLLABORATION: In the interest of cooperation, we invest time and energy in collaborative efforts, such as the New Mexico Avian Protection working group, the NM Avian Conservation Partners, the Prairie Falcon working group of the American West and Canada, and a monthly zoom meeting for Raptor Rescue, open to the public. In 2023, we are co-hosting the Raptor Research Foundation International Conference in Albuquerque October 17-21.

Learn more about Hawks Aloft, Inc. at hawksaloft.org

We provide a wide range of services to members and the general public including:

- Local field trips for watching birds and enjoying nature
- Conservation education programs featuring live birds of prey
- Avian and conservation advocacy in New Mexico and the American West
- New Mexico Raptor Rescue – a statewide hotline staffed 24/7 and 365 days/year
- International tours for members
- Monthly on-line member newsletter

LOCAL CONFERENCE COMMITTEE CO-CHAIRS

President, Hawks Aloft, Inc.
Gail Garber
United States

Raptor Research Foundation
Joan Morrison
United States

ACKNOWLEDGMENTS

Planning for the 2023 Raptor Research Foundation conference involved the dedicated participation of co-hosts Gail Garber, executive director of Hawks Aloft, Inc., and Joan Morrison (RRF), as well as numerous others. The planning process began in early 2021, driven largely by Joan, former secretary of RRF now comfortably retired in the Land of Enchantment. Covid put a damper on our meetings in 2020 and 2021, and in 2022 a smaller-scale but successful in-person conference was held in Fort Lauderdale, Florida. Since then, Joan, Gail and the local committee have worked hard and are excited to offer a full-fledged in-person conference in Albuquerque, in October 2023. Our application to host was approved by RRF in June 2021 and we signed our hotel contract in August 2021.

Kathy Webber of Maritz Global Events was extremely helpful in securing the Marriott Hotel in Albuquerque, and she negotiated many additional benefits. At the Marriott, Jasmin Noorullah-Wright and Ana Marie Torres were incredibly patient, expertly answering all our questions about how to pull off a conference at a major hotel. Dan Varland and Libby Mojica provided invaluable guidance during our application and planning process. Donna Marain, local host of the 2022 RRF conference provided welcome insights and assistance in planning. Megan Judkins managed the conference website and Christy Classi managed the Wild Apricot registration website and conference finances. We can't thank Megan and Christy enough for ensuring that every conference guest got exactly what they needed and for promptly addressing all conference-related issues, especially the last minute ones!

We are grateful to others on our greater Albuquerque team, all of whom provided excellent services - Eric May and his team at Alliance AV, Wyatt Keltner at Enterprise for helping us fill our transportation needs, Marcel Lucero at Convention Services of the Southwest for assisting with the poster session, Analisa Aragon for setting up the special event at the Indian Pueblo Cultural Center, and Bob Parmenter for leading an excellent field trip to Valles Caldera.

RRF's conference committee chair, Sandy Boyce, and RRF's President, Rob Bierregaard were helpful in keeping the planning process on track and making sure all logistical details were completed in a timely manner. Rob Bierregaard helped recruit excellent plenary speakers. Rebecca McCabe and the Conference Futures committee did an amazing job recruiting panelists and pulling together the panel of indigenous biologists. Trish Miller, Lizzy Meisman, and Laura Echávez helped with setting up the joint Diversity, Equity, and Inclusion committee and Early Career Raptor Researchers social event and lining up our ECRR volunteers. Marie Sophie Garcia-Heras and Rebecca McCabe stepped up as scientific co-chairs and did an outstanding job organizing all the abstracts and holding authors to deadlines. They made interacting with and using Oxford Abstracts look easy! Thanks also to the symposium leaders, who organized these excellent contributions and to the workshop leaders for stepping up to lead these important education offerings at our conference.

There was so much talent and hard work within the Local Committee: Trevor Fetz, Evelyn McGarry, Liz Roberts, Jenny Sternheim, and Maggie Stein, a former Hawks Aloft staff member, were all up to the tasks to which they were assigned. We thank the remarkably patient Scott Waters for the graphic design of the conference program book and Danny Trujillo at Starline printers for the final product. Michelle Dent organized and coordinated the silent auction, the first we've had at a conference in many years. Other volunteers who helped make our conference a success included Joanna Strange, Steve McGehee, Cathy Moore, and Jennifer Owen-White.

We also thank the remarkably talented and generous photographers who donated their work for use in the conference program book: Alan Murphy, Doug Brown, Kristin Brown, Tony Giancola, and Larry Rimer.

There are many others who have given invaluable contributions of time, information, advice, and more to this conference. Thanks to you all!

Finally, we are grateful to Joe Jojola, who donated one of his fine paintings for our silent auction. Joe remembers playing, fishing, and hunting along the Rio Grande behind the family home in Isleta Pueblo. He inherited an artistic gift from his parents, which he has indulged throughout his long career as a tribal wildlife biologist in Arizona and New Mexico. Joe's understanding of wild creatures shows through in his art, and we are thrilled that he has donated this beautiful painting of a first year Golden Eagle in an iconic New Mexico landscape to our silent auction. We also thank Dale Stahlecker for making the connection with Joe.

Local Conference Committee Co-chairs: Joan Morrison (RRF) and Gail Garber (Hawks Aloft, Inc.)

PHOTOGRAPHY

Alan Murphy (Cover, p. 9, 49, 72, 95, Back Cover), Larry Rimer (p. 29, 33). Doug Brown (p. 24, 52), Kristin Brown (p. 11, 12), Tony Giancola (p 28, 89)

RRF PRESIDENT'S WELCOME

ON BEHALF OF THE RAPTOR RESEARCH FOUNDATION...

On behalf of everyone at the Raptor Research Foundation and Hawks Aloft, Inc., I extend a warm greeting and welcome to the 2023 annual conference attendees. After almost 30 years (we met in 1994 in Flagstaff), we are thrilled to welcome you all back to the Southwest—this time in the beautiful state of New Mexico—for this year's international conference.

Needless to say, we are delighted to be hosting our second in-person meeting post-COVID as the world settles back into our old rhythms.

Both ancient and cutting-edge, equal parts cool and quaint, Albuquerque is an oasis in the high desert, full of people with rich histories and cultures. Recognized as one of the most culturally diverse cities in the country, Albuquerque's ethnic tapestry is reflected in its architecture, artwork, cultural centers, and cuisine. And with spectacular weather and a myriad of outdoor activities, Albuquerque has something to experience for adventurers of all types. Learn more about our conference city here https://www.newmexico.org/plan/.

Home to two national parks (Carlsbad Caverns and White Sands), two national historical parks (Chaco Culture and Pecos), one national heritage area (Northern Rio Grande), and 11 national monuments, New Mexico represents the best of the southern Rocky Mountains and the Desert Southwest. More than 38 million people visit the state each year to enjoy easy access to all types of outdoor recreation, rich cultural history, and of course, the famous cuisine featuring red and green chile. You can have either, but if you want both just ask for "Christmas!"

If this is your first visit to New Mexico, our local committee is eager to welcome you. And they'll be happy to help you plan your return trip—they know you'll come back for more. For those familiar with the area, our hosts look forward to helping you experience something new through the off-site events and field trips we have planned. If you forgot to sign up for one of our excursions, check at registration when you arrive to see if there have been any cancellations, as I'm sure by the time you read this, all the slots on the field trips will be booked. We're excited about continuing our support of raptor research internationally. This will be the second year for our Wings to Fly travel grant program. The "W2F" awards support researchers traveling from overseas to attend our annual conferences. This year we awarded grants for five raptor researchers, from Mongolia, Peru, India, and Puerto Rico.

Our local host committee chairs, Joan Morrison and Gail Garber, and their volunteers have been hard at it for over a year making sure this will be another meeting we'll all enjoy and remember for a long time.

So, please enjoy your time in Albuquerque and at our meeting. I'm sure you will renew old friendships, make new ones, maybe add a raptor to your life list, learn about raptor species you didn't know well, and get ideas for new research topics and techniques that will enhance your work with the birds we are all so passionately dedicated to.

Onward!

Rob Bierregaard

President, Raptor Research Foundation

MAYOR'S LETTER

CITY OF ALBUQUERQUE

Dear Raptor Research Foundation Guests:

On behalf of the City of Albuquerque, I am pleased to welcome you to our beautiful city and the Raptor Research Foundation 2023 Conference. We are so lucky to have more than 20 species of raptors either residing in or passing through New Mexico.

Albuquerque is a community that boasts an abundance of attractions. While here, I hope you are able to explore all that our vibrant and diverse city has to offer. You can take a stroll in Old Town, and visit the Albuquerque Museum, The New Mexico Museum of Natural History, and Explora! In our Downtown area, please take advantage of one of the many restaurants, coffee shops, or brew pubs. You may also want to consider visiting the Indian Pueblo and National Hispanic Cultural Centers, The Albuquerque BioPark (Zoo, Aquarium and Botanic Gardens), or catch a Minor League Albuquerque Isotopes baseball game.

I trust you will enjoy Albuquerque's charm while you are here.

I wish you all the best during your Conference and come back and see us again during your travels.

Sincerely,

Mayor Timothy M. Keller

Mayor Timothy M. Keller
Albuqueruque, NM

Albuquerque - Making History 1706-2006

LAND ACKNOWLEDGMENT

"We are the descendants of the original stewards and caretakers of these lands. Our lifeways include the recognition that human beings are but one component of the ecosystem and natural world. We strive to continue the legacy that our ancestors left to us: living in healthy relationships with the land, water, air, and all the inhabitants of these ecosystems. Our people have lived in connection to these sacred lands for generations and will continue to protect and learn from them.

We acknowledge that these places have been objectified and exploited for the comfort and benefit of the privileged few. Displacement of our ancestors from our homelands and the continued trauma experienced by our people is not only acknowledged, but remembered and re-lived through current systemic injustice. Stewardship involves a constant acknowledgement of these truths and a disruption of the continuing efforts to damage the lands and the inhabitants thereon."

BRITTANY CHAVARRIA

Park Ranger- Valle de Oro National Wildlife Refuge

Brittany was born and raised in Isleta Pueblo, New Mexico and has been involved with Valle de Oro National Wildlife Refuge since its establishment in 2012. She received her Associates in Anthropology while starting an AmeriCorps internship at Valle de Oro through Ancestral Lands Conservation Corps in early 2021. In May of 2023, she transitioned from an intern to an official staff member at Valle de Oro NWR. As a Park Ranger, she collaborates with her team members to create and implement educational and interpretive programming, organize events, and plan activities for visitors to engage in during their visit at the refuge. Brittany's most meaningful accomplishment over the past two and a half years has been the establishment of the Isleta Pueblo summer youth hiking club. This is important to her because she has the opportunity to build vital relationships and mentor the youth from the community she comes from. Brittany's biggest goal is to continue both her personal and professional development in meaningful ways that allow her to continue giving back to the land and her community.

CONFERENCE SCHEDULE

RRF CONFERENCE PROGRAM

TUESDAY, OCT. 17, 2023

08:00 - 17:00	RRF BOARD MEETING - Cimarron Room

WEDNESDAY, OCT. 18, 2023

08:00 - 12:00	Raptor Necropsy Workshop - Las Cruces Room Molt and Aging Workshop - Carlsbad Room Harnessing Raptors Workshop - Santa Fe Room
13:00 - 17:00	Permitting Workshop - Las Cruces Room Techniques for Handling Raptors Workshop - Carlsbad Room Bayesian Modeling Workshop - Santa Fe Room
17:30 - 20:00	ICEBREAKER SOCIAL EVENT - Pecos/Sandia/Acoma Rooms

THURSDAY, OCT. 19, 2023

ROOM	SALON A-E	SALON F	SALON G-H	SALON I-J
08:00 - 09:00	Morning Welcome, Announcements, and Awards			
09:00 - 10:00	Plenary: Project SNOWstorm's Studies of Snowy Owls: A Model for Collaborative, Crowd-funded Raptor Research *- Scott Weidensaul*			
10:00 - 10:30	Morning Coffee Break			
10:30 - 12:00	Connecting Worlds: Indigenous World Views, Science, and Sovereignty in Raptor Research and Conservation *- Robert Mesta, Aimee Roberson, Tiana Williams-Claussen*			
12:00 - 14:00	LUNCH BREAK - ECRR/DEI Luncheon & Social - Cimarron/Las Cruces Rooms			
14:00 -15:30	**Burrowing Owl Symposium** **14:00 - 14:30** [Abstract #S01] What are integrated population models and how might they contribute to Burrowing Owl conservation? *Brian Millsap*	**Movement Ecology** **14:00 - 14:15** [G01] Influence of prey availability on home range size of Saker Falcons provisioning nestlings in Mongolia *Batbayar Bold*	**Andersen Award Student Presentations** **14:00 - 14:15** [AA01] Cooperative breeding in South Texas Harris's Hawks revisited: male-biased delayed dispersal, mixed parentage broods, and the relatedness of adult helpers *Andrea L Gibbons*	**Breeding Biology** **14:00 - 14:15** [G07] Nest reuse patterns for four species of raptors in Southern California across seven years of the Los Angeles Raptor Study *Daniel S Cooper*
		14:15 - 14:30 [G02] Assessing the effects of thermal factors on the spatial ecology of a critically endangered African vulture *Caroline G Hannweg*	**14:15 - 14:30** [AA02] Snow modulates movements and fitness of a facultative migrant, the Great Gray Owl *Katherine Gura*	**14:15 - 14:30** [G08] Nest success of Bald Eagles exposed to anthropogenic activities in the United States *Jay Gedir*
	14:30 - 14:45 [S02] Burrowing Owl demography and nesting ecology in San Diego County, California, USA *Colleen L Wisinski*	**14:30 -14:45** [G03] Insights in the movement ecology of Pueo (Hawaiian Short-eared Owl) in Hawai'i. *Marie-Sophie Garcia-Heras*	**14:30 - 14:45** [AA03] Impacts of habitat type on individual Prairie Falcon movement and foraging behavior during the breeding season *Eden S Ravecca*	**14:30 - 14:45** [G09] Productivity and nest survival of White-tailed Hawks in south Texas during the 2021-2023 breeding seasons *Madeleine T Barham*
	14:45 -15:00 [S03] Population trends in an urban, resident Burrowing Owl population in northern California *Lynne A Trulio*	**14:45 - 15:00** [G04] To cross or not: what conditions facilitate a crossing attempt of a soaring migrant in the Straits of Mackinac? *Nick A Alioto*	**14:45 - 15:00** [AA04] Modeling goshawk nesting habitat selection in southern Colorado *Derek J Schleicher*	**14:45 - 15:00** [G10] American Kestrel nest survival and productivity across a decade in the Southern High Plains of Texas *Sarah A Fonville*
	15:00 - 15:15 [S04] Extirpation of Orange County, California breeding Burrowing Owl population: the convergence of philopatry, habitat fragmentation, & Allee effects *Peter H Bloom*	**15:00 - 15:15** [G05] Northern Hawk Owl winter habitat use and movement in Minnesota and Manitoba *Hannah Toutonghi*	**15:00 - 15:15** [AA05] Assessing occupancy of an elusive forest raptor using passive acoustical monitoring *Natia Javakhishvili*	**15:00 - 15:15** [G11] Land-use preferences of two Argentinian Caracaras *Natividad Aguilera-Alcalá*

ROOM	SALON A-E	SALON F	SALON G-H	SALON I-J
14:00 -15:30	**15:15 - 15:30** [S05] Burrowing Owl survival, nest survival and productivity in anthropogenic habitats of the American Southwest *Martha Desmond*	**15:15 - 15:30** [G06] Breeding biology and migration ecology of Turkey Vultures in western Montana *Brian T Busby*	**15:15 - 15:30** [AA06] Independence Day: comparison of methods to estimate the onset of dispersal in raptors *Diego Gallego*	**15:15 - 15:30** [G12] Swainson's Hawk philopatry and nest-site fidelity result in ecological trap *Peter H Bloom*
15:30 -16:00	**Afternoon Coffee Break**			
16:00 -17:30	**Burrowing Owl Symposium II** **16:00 - 16:15** [S06] Results of a 15-year Burrowing Owl demographic study in north-central Oregon *David H Johnson*	**Movement Ecology II** **16:00 - 16:15** [G13] Ferruginous Hawk home range and habitat use in western Wyoming *Sarah K Ramirez*	**Andersen Award Student Presentations II** **16:00 - 16:15** [AA07] Biological factors associated with the autumn departure timing of North American migratory raptors across a broad-scale *Nora R Honkomp*	**Breeding Biology II** **16:00 - 16:15** [G19] Distribution, nesting records and notes on the ecology of the White-throated Caracara *Juan M Grande*
	16:15 - 16:30 [S07] Demographic data from Burrowing Owls in Idaho for integrated population modeling *Jim Belthoff*	**16:15 - 16:30** [G14] GPS satellite tracking of Sharp-shinned Hawk in western North America *Jesse L Watson*	**16:15 - 16:30** [AA08] Status and conservation challenges of vultures in Pokhara, Nepal: globally threatened species *Hemanta Dhakal*	**16:15 - 16:30** [G20] Breeding distribution and threats for the endangered Black-and-Chestnut Eagle in Argentina *Juan M Grande*
	16:30 - 16:45 [S08] Latitudinal patterns in survival, fecundity, migration, dispersal, and fidelity of Burrowing Owls in North America *Courtney J Conway*	**16:30 -16:45** [G15] Close to home or room to roam: do space use and nest metrics of nesting American Kestrels vary by landscape? *Jessica M Taylor*	**16:30 - 16:45** [AA09] Factors influencing occupancy, success, and nestling growth at American Kestrel nest boxes in the Upper Midwest *Halle Lambeau*	**16:30 - 16:45** [G21] Current status of breeding population of Western Osprey in Abu Dhabi, United Arab Emirate *Shakeel Ahmed*
	16:45 - 17:00 [S09] Burrowing Owl population trends, nest survival and productivity across Great Plains grasslands *Martha Desmond*	**16:45 - 17:00** [G16] Winter refuge in the Lone Star State: examining American Kestrels' habitat use in North Texas *James C Bednarz*	**16:45 - 17:00** [AA10] Disentangling trophic dynamics of sympatric raptors in the Tagus Estuary during the non-breeding period *João Salvador Falé*	**16:45 - 17:00** [G23] A novel approach to the nest site characterization of two species of critically endangered vultures *Rebecca C Bishop*
	17:00 - 17:30 **Symposium Discussion**	**17:00 - 17:15** [G17] Seasonal home ranges and migration of Zone-tailed Hawks from the Trans Pecos of Texas *Clint W Boal*		
		17:15 - 17:30 [G18] Housing the Barred Owl in Alberta, Canada's boreal and foothills *Lisa Takats Priestley*		
17:30 -19:30	**EVENING POSTER SESSION AND RECEPTION - Pecos/Sandia/Acoma Rooms**			
20:00 -22:00	**WOMEN IN RAPTOR RESEARCH AND CONSERVATION MEET-UP - *BJ'S RESTAURANT***			
	FRIDAY, OCT. 20, 2023			
08:00 - 08:30	Morning Announcements and Awards			
08:30 - 09:30	Plenary: A 50-year Perspective on Conservation of Northern Goshawks - *Pat Kennedy*			
09:30 - 10:00	**Morning Coffee Break**			
10:00 - 12:00	**Contemporary Issues in the Conservation and Management of North American Raptors** **10:00 - 10:30** [S10] The history of raptor conservation and management in North America *Karen Steenhof*	**Mitigation and Human Wildlife Conflict** **10:00 - 10:15** [G24] A review of the effects of wind farms on raptors and potential mitigation strategies *Irene Estellés-Domingo*	**Pathology and Toxicology** **10:00 - 10:15** [G32] Mitigating threats to nestling Golden Eagle survival and health: a prescription for the treatment of nest ectoparasites and disease *Julie A Heath*	**Occupancy and Monitoring** **10:00 - 10:15** [G40] Burrowing Owl monitoring, conservation research, and translocation in San Diego County, California *Susanne Marczak*
		10:15 - 10:30 [G25] Data-driven predictive movement model for raptors using look-ahead environmental conditions *Rimple Sandhu*	**10:15 - 10:30** [G33] Nest parasites reduce reproductive success in a recovering raptor population *Javan M Bauder*	**10:15 - 10:30** [G41] Sharing is caring: The role of sociality in foraging efficiency of obligate scavengers *Sandra Cuadros*

RRF CONFERENCE PROGRAM

FRIDAY, OCT. 20, 2023 continued...

ROOM	SALON A-E	SALON F	SALON G-H	SALON I-J
10:00 - 12:00	**10:30 - 10:45** [S11] Raptor electrocutions –impacts and mitigation *Richard E Harness*	**10:30 - 10:45** [G26] Using GPS tracking to understand, map, and mitigate win turbine collision risk for raptors *Megan Murgatroyd*	**10:30 - 10:45** [G34] Birds groom more in regions with higher parasite pressure: a comparison of temperate and subtropical American Kestrels *Dale H Clayton*	**10:30 - 10:45** [G42] Wintering survival of American Kestrels in central Illinois, USA *Tih-Fen Ting*
	10:45 - 11:00 [S12] A review of renewable energy impacts and mitigation for raptors *Adam E Duerr*	**10:45 - 11:00** [G27] Using GPS tracking of Martial Eagles to inform future wind farm development *Chris Vennum*	**10:45 - 11:00** [G35] Grooming time predicts survival: American Kestrels on a subtropical island *Sarah E Bush*	**10:45 - 11:00** [G43] Unveiling an anomaly: non-direct migration of a male American Kestrel (E/78) and its implications for understanding the annual cycle *Madeleine Kaleta*
	11:00 - 11:15 [S13] Understanding toxicants that influence raptors: monitoring, analysis, physiological and demographic consequences *Vincent A Slabe*	**11:00 - 11:15** [G28] Summarizing publicly available raptor fatality reports from wind farms across the contiguous United States and Canada *Katheryn A Watson*	**11:00 - 11:15** [G36] Emerging mortality in White-tailed Sea Eagle nestlings: apex-predators struggle with enzootic circulation of highly pathogenic avian influenza virus of subtype H5 (2.3.4.4b) in Europe *Anne Günther*	**11:00 - 11:15** [G44] Pitfalls arising from site selection bias in population monitoring defy simple heuristics *Brian W Rolek*
	11:15 - 11:30 [S14] Collisions between raptors and aircraft: a growing issue in the airport environment? *Brian E Washburn*	**11:15 - 11:30** [G29] Cryptic population response of Golden Eagles to wind-energy production in an oak savannah landscape *Patrick S Kolar*	**11:15 - 11:30** [G37] Genomic signatures of selection for resistance to lead exposure in Turkey Vultures *Alexandria B Koedel*	**11:15 - 11:30** [G45] Changes in habitat and Golden Eagle territory occupancy in the Morley Nelson Snake River Birds of Prey National Conservation Area from 1985-2022 *Ashley L Santiago*
	11:30 - 11:45 [S15] Impact of wildfire on raptor communities *Gavin M Jones*	**11:30 - 11:45** [G30] Automated curtailment proves effective at reducing Golden Eagle mortality at a California wind facility *Julie Garvin*	**11:30 - 11:45** [G38] Lead and oxidative stress in migrant and resident Turkey Vultures in California *Alexandra M Eagleton*	**11:30 - 11:45** [G46] Drones save time and effort: assessing the effectiveness of commercial drones for monitoring Bonelli's Eagles and Golden Eagles during the breeding season *Pascual López-López*
	11:45 - 12:00 [S16] Climate change and migration of raptors *Laurie J Goodrich*	**11:45 - 12:00** [G31] Distribution models and mapping tool for year-round prioritization of Golden Eagle habitat *Katherine Gura*	**11:45 - 12:00** [G39] Potential for lead exposure to scavengers utilizing hunter killed oryx on White Sands Missile Range, New Mexico *Tom Hudson*	**11:45 - 12:00** [G47] Results of long-term monitoring of Ferruginous Hawks across their breeding range in Nevada *Joseph G Barnes*
12:00 - 13:30	LUNCH BREAK			
13:30 - 15:00	**Contemporary Issues in the Conservation and Management of North American Raptors II** **13:30 - 13:45** [S17] Climate change and raptors occupying North American arid lands *Brent D Bibles*	**Mitigation and Human Wildlife Conflict II** **13:30 - 13:45** [G48] Habitat selection and flight altitude of Black Vultures influences collision risk with aircraft *Adam E Duerr*	**Pathology and Toxicology II** **13:30 - 13:45** [G54] High rates of exposure to anticoagulant rodenticides in urban raptors in western Washington state *Patti Loesche*	**Occupancy and Monitoring II** **13:30 - 13:45** [G56] Importance of DoD-conserved lands to Golden Eagle populations: monitoring of Golden Eagles occupying an active military test range in southern New Mexico *Tom Hudson*
	13:45 - 14:00 [S18] How will raptors respond to a rapidly warming Arctic? *Carol L McIntyre*	**13:45 - 14:00** [G49] Evaluation of mitigation translocation as a management tool to reduce conflicts between humans and American Kestrels *Brian E Washburn*	**13:45 - 14:00** [G55] Anticoagulant rodenticide toxicity in terrestrial raptors: tools to estimate the impact on populations in North America and beyond *John E Elliott*	**13:45 - 14:00** [G57] Rise and demise of tropical island raptors: the post hurricane occupancy shift of the endangered and endemic Puerto Rican Broad-winged Hawk and generalist Red-tailed Hawk *Isamar M Flores-Rodríguez*
	14:00 - 14:15 [S19] Real and perceived conflicts associated with raptor population increases *Clint W Boal*	**14:00 - 14:15** [G50] Owls and airports: a perilous match on the tarmac *Rebecca A McCabe*		**14:00 - 14:15** [G58] Owl species composition and general abundance at Valles Caldera National Preserve, New Mexico *Trevor W Fetz*

ROOM	SALON A-E	SALON F	SALON G-H	SALON I-J
13:30 - 15:00	**14:15 - 14:30** [S20] Assessment of falconry take on raptor populations *Brian Millsap*	**14:15 - 14:30** [G51] Translocation of non-adult Bald Eagles in the Chesapeake Bay region has limited management implications for bird aircraft strike hazard *Tricia A Miller*	**Phylogeny and Taxonomy** **14:15 - 14:30** [G61] Towards a macro-theoretical framework to analyze the biology of raptors *Matias Alejandro Juhant*	**14:15 - 14:30** [G59] Design of the urban and industrial garden based on Ferruginous Pygmy-Owl behavior in the Costa Rican Central Valley *Emmanuel Guzmán*
	14:30 - 14:45 [S21] Barred Owl removal halts long-term population declines of Spotted Owls in old forests of the Pacific Northwest *J David Wiens*	**14:30 - 14:45** [G52] Quantifying Golden Eagle-vehicle strike risk and mitigation in the western USA *Steven J Slater*	**14:30 - 14:45** [G62] A comprehensive whole-genome phylogeny for the Red-tailed Hawk *Bryce W Robinson*	**14:30 - 14:45** [G60] Evaluating convolutional neural network models detection of Northern Spotted Owl vocalizations *Matthew Hane*
	14:45 - 15:00 [S22] Human dimensions of raptor conservation and persecution: Golden Eagles of the American West *Kenneth E Wallen*	**14:45 - 15:00** [G53] Are raptor vehicle strikes cause for concern? A review of data from western Wyoming *Victoria E Thorpe*	**14:45 - 15:00** [G63] Using ultraconserved elements and legacy markers to address the non-monophyly of the genus Accipiter (Accipitriformes: Accipitridae) *Therese A Catanach*	
15:00 - 15:30	**Afternoon Coffee Break**			
15:30 - 17:00	**Contemporary Issues in the Conservation and Management of North American Raptors III** **15:30 - 15:45** [S23] Raptor management on tribal lands of the Western United States *Megan E Judkins*	**Mitigation and Human Wildlife Conflict III** **15:30 - 15:45** [G64] Safe and legal access to telecom equipment hosting nesting birds: bridging the gap between service-reliability and nest success *Kathy M Maechtle*	**Phylogeny and Taxonomy II** **15:30 - 15:45** [G70] Conserving the evolutionary history of birds *Christopher JW McClure*	
	15:45 - 17:00 Symposium Discussion	**15:45 - 16:00** [G65] Saving raptors in Mongolia: country-scale retrofitting of insulation to reduce avian electrocution at power lines *Munir Z Virani*	**15:45 - 16:00** [G71] Taxonomic status of Bay-winged Hawk and Harris's Hawk, with documentation of delayed plumage maturation in Bay-winged Hawk *William S Clark*	
		16:00 - 16:15 [G66] A golden opportunity: investigating the effectiveness of Golden Eagle relocation as a management strategy to mitigate sheep depredation in Wyoming *Kristen Amicarelle*	**16:00 - 16:15** [G72] Timing of emergence of sexual size dimorphism in American Barn Owl nestling development *Emily M Phillips*	
		16:15 - 16:30 [G67] Dead birds flying: can North American rehabilitated raptors released into the wild mitigate anthropogenic mortality? *Christian A Hagen*	**16:15 - 16:30** [G73] Ecomorphological adaptations of owl feet and talons *JF Therrien*	
		16:30 - 16:45 [G68] Does the release of Bonelli's Eagle from captive breeding nucleus contribute to population rehabilitation? *Asaf Mayrose*	**16:30 - 16:45** [G74] Raptor research and natural history museums: start of the Raptor Research and Museum Collections Committee *Elizabeth Wommack*	
		16:45 - 17:00 [G69] Post-release survival of Golden Eagles following clinical rehabilitation from injury and disease *Robert K Murphy*		
17:30 - 21:30	**DINNER AT THE INDIAN PUEBLO CULTURAL CENTER**			

RRF CONFERENCE PROGRAM

SATURDAY, OCT. 21, 2023

ROOM	SALON A-E	SALON F	SALON G-H	SALON I-J
08:00 - 09:00	Morning Announcements and Awards			
09:00 - 10:30	Break-out Sessions for Networking - Cimarron, Las Cruces. Carlsbad Rooms			
	Updating Incidental Take Permit Decisions in a Changing Climate - Pecos Room			
	Prairie Falcon Working Group - Sandia Room			
10:30 - 12:00	**Conservation and Population Updates** **10:30 - 10:45** [G75] Declining richness, abundance, and productivity of raptors nesting at the central plains experimental range *James F Dwyer*	**Lightning Talks** **10:30 - 10:37** [LT01] Testing adaptive flexibility in breeding Swainson's Hawk nest selection *Elizabeth Meisman* **10:37 - 10:44** [LT02] The reintroduction of Osprey's to Ireland *Zoe Smith*		**Diet and Feeding Ecology** **10:30 - 10:45** [G81] Provisioning rates and prey composition of a declining predator, the Little Owl, in contrasting European farmlands *Sangeeth Sailas*
	10:45 - 11:00 [G76] Evaluating the effects of nest management on a recovering raptor population using an integrated population model *Caroline D Cappello*	**10:44 - 10:51** [LT03] Modelling territory occupancy of large falcons in Hungary *Mátyás J Prommer* **10:51 - 10:58** [LT04] Do Verreaux's Eagles fly at night? Implications for future wind farm developments *Chris Vennum*		**10:45 - 11:00** [G82] Ferruginous Hawk diet and behavior in two areas in New Mexico which differ in degree of anthropogenic alteration *William H Keeley*
	11:00 - 11:15 [G77] Collaborative research prioritization to evaluate potential drivers of population declines for the American Kestrel in the United States *Kristin P Davis*	**10:58 - 11:05** [LT05] Golden Eagle winter feeding *Cody Allen* **11:05 - 11:12** [LT06] The effect of roadside noise and pairing status on the foraging success of wintering American Kestrels in North Texas *Heather E Bullock*		**11:00 - 11:15** [G83] Contrasting DNA metabarcoding sampling methods to describe Rough-legged Hawk winter diet *Neil Paprocki*
	11:15 - 11:30 [G78] Population changes in a western raptor guild up to 18 years after wind power development in the Pacific Northwest, USA *James W Watson*	**11:12 - 11:19** [LT07] Observations of Bat Falcon hunting behavior in western Mexico *Robert M Palmer* **11:19 - 11:26** [LT08] Translocations in Merlins to protect the endangered Piping Plover *Fernando G Lopez*		**11:15 - 11:30** [G84] Insect prey diversity, biomass, and parental foraging efforts in Flammulated Owls of northern Utah *Markus Mika*
	11:30 - 11:45 [G79] Estimating American Kestrel population vital rates at a broad geographic scale *Paige E Howell*	**11:26 - 11:33** [LT09] An experimental approach to assess scavenging dynamics in roadside areas *Natividad Aguilera-Alcalá* **11:33 - 11:40** [LT10] Recovery of a historically persecuted Golden Eagle breeding population in the Trans-Pecos Region, West Texas, USA *Dale W Stahlecker* **11:40 - 11:47** [LT11] Polygyny in Barred Owls: cooperative breeding between two females and a male at the same nest *Richard O Bierregaard*		**11:30 - 11:45** [G85] Into the realm of Harris's Hawks: unraveling social dynamics through VHF telemetry in South Texas *Brooke A Poplin*
	11:45 - 12:00 [G80] Assessing population status of North American diurnal raptors using migration and winter counts *Dave Oleyar*			**11:45 - 12:00** [G86] Advancing methods of diet analysis: a case study using degraded Merlin prey remains *Stephen B Lewis*

ROOM	SALON A-E	SALON F	SALON G-H	SALON I-J
		11:47 - 11:54 [L12] The major threats faced by endangered Egyptian Vultures in Uttar Pradesh, India Shivangi Mishra		
12:00 - 13:30	LUNCH BREAK			
13:30 - 16:00	**Conservation and Population Updates II** **13:30 - 13:45** [G87] A conservation plan for Golden Eagles in eastern North America *Vincent A Slabe*	**Fire Ecology Symposium** 13:30 - 13:45 [S24] Effects of the Woolsey Fire on nesting territories of Southern California Red-tailed Hawks *Jane Gao*		**Advances in Raptor Health Symposium** 13:30 - 13:45 [S32] Effects of clade 2.3.4.4 highly pathogenic H5N1 influenza A virus on Bald Eagles & Black Vultures in the Southeastern USA *Nicole M Nemeth*
	13:45 - 14:00 [G88] Rapidly declining Peregrine Falcon population in New Mexico, USA, during 2016-2023 *Terrell H Johnson*	**13:45 - 14:00** [S25] Habitat selection, demography, and evolutionary ecology of Spotted Owls in fire-prone forests of the Southwestern United States: implications for conservation *Gavin M Jones*		**13:45 - 14:00** [S33] Utilization of wildlife rehabilitation for surveillance — 2022 outbreak of highly pathogenic avian influenza virus *Victoria Hall*
	14:00 - 14:15 [G89] Conservation status and prospects of critically endangered vultures in Ghana and Togo, West Africa *Nico Arcilla*	**14:00 - 14:15** [S26] Fire legacies and megafires determine Flammulated Owl occupancy in the Sierra Nevada *Kate McGinn*		**14:00 - 14:15** [S34] Clinical presentation and pathology findings in raptors infected with Highly Pathogenic Avian Influenza Virus (H5N1 clade 2.3.4.4b) *Dana Franzen-Klein*
	14:15 - 14:30 [G90] Abundance, distribution, and conservation status of diurnal raptors at southern wetlands of Benin, West Africa *Nico Arcilla*	**14:15 - 14:30** [S27] Wildfire response of GPS-tracked Bonelli's Eagles in Eastern Spain *Sara Morollón*		**14:15 - 14:30** [S35] Techniques and practical application of feather imping to shorten captive care times in wildlife rehabilitation *Emily M Davenport*
	14:30 - 14:45 [G91] Rapid and recent range collapse of Australia's rarest raptor, the Red Goshawk *Christopher MacColl*	**14:30 - 14:45** [S28] Garrkan–an Australian raptor using fire to effect landscape-scale management in savannah woodlands *Robert A Gosford*		**14:30 - 14:45** [S36] Indolent corneal ulcer in a Great Horned Owl: diagnostic evaluation, treatment strategies, and complications *Emily M Davenport*
	14:45 - 15:00 [G92] Restoring Barbary Falcon population in Saudi Arabia by using a novel technique *Matyas J Prommer*	**14:45 - 15:00** [S29] Synergies and trade-offs: identifying mutually beneficial goals for fuel reduction treatments and conservation of Spotted Owls in the Sierra Nevada *Marilyn E Wright*		**14:45 - 15:00** [S37] Anticoagulant rodenticide exposure in owls and diurnal raptors *Christine V Fiorello*
	15:00 - 15:15 [G93] Conservation of a threatened species with stakeholders on Grouse Moors in the English Uplands *Jemima Parry-Jones*	**15:00 - 15:15** [S30] Multi-scale habitat selection by Northern Goshawks in a fire-prone forest *Colin P Dillingham*		**15:00 - 15:15** [S38] Detection of Chlamydia buteonis in Red-tailed Hawks in 13 counties in California during winter 2022 *Michelle G Hawkins*
	15:15 - 15:30 [G94] The return of the White-tailed Eagle to England, UK *Zoe Smith*	**15:15 - 15:30** [S31] Using prescribed fire in Mexican Spotted Owl occupied habitat: results of a collaborative management experiment *Shaula J Hedwall*		**15:15 - 15:30** [S39] Trace element exposure in Golden Eagle nestlings across western Utah *Dustin M Maloney*
	15:30 - 15:45 [G95] Using large-scale datasets to inform management of raptor populations *Emily R Bjerre*	**15:30 - 16:00** Symposium Discussion		**15:30 - 16:00** Symposium Discussion
16:15 - 17:15	MEMBER MEETING - Salon A-E			
17:30 - 18:30	MINGLE AND COCKTAILS - Conference Foyer Area			
18:30 -21:30	EVENING CELEBRATION - BANQUET AND AWARDS - Pecos/Sandia/Acoma Rooms			

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RRF representative on the Ornithological Council
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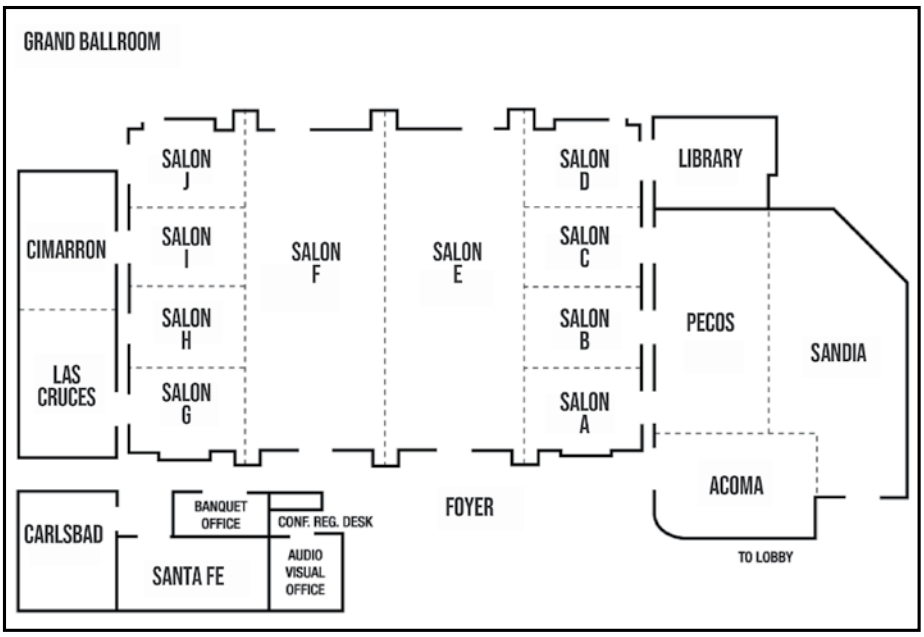
Jim Bednarz
United States

GENERAL CONFERENCE INFORMATION

VENUE INFORMATION

The Marriott Albuquerque offers the comfort and convenience you expect when you travel. Situated along I-40, the Marriott provides easy access to the University of New Mexico, Sandia Peak Tramway, Coronado Center and other popular destinations. If you want to stay active, fuel up at the on-site restaurant, Cielo Sandia, before dropping by the 24-hour fitness center with an array of cardio equipment and free weights. If you prefer to relax, take a refreshing dip in the hotel's indoor and outdoor pool.



Venue Address

Marriott Uptown Albuquerque
2101 Louisiana Boulevard NE
Albuquerque, NM, USA 87110
505-881-6800

REGISTRATION

RRF 2023 Registration includes:

- Admittance to three days of scientific paper sessions, plenaries, symposia and panel
- Wednesday night icebreaker social
- Thursday evening poster session
- Name tag and program book with abstracts
- QR code for electronic access to the Scientific Program

Registration in the foyer of the conference area

15:00 to 18:00 on Tuesday
8:00 to 18:00 on Wednesday, Thursday and Friday
8:00 to 12:00 on Saturday

Family room: the Library

This room will be open 8:00 to 17:00 every day of the conference

Silent Auction

Begins Thursday Oct. 19. Items will be available for viewing and bidding during coffee breaks and lunch break and until 17:00 on Thursday Oct 19 and Friday Oct. 20, and during the networking sessions on Saturday Oct 21. Auction closes Saturday Oct. 21 at noon. Winners will pay for and retrieve items before and after the banquet Saturday night.

LOCAL EATERIES AND ENTERTAINMENT

One of the city's most rapidly evolving districts, Uptown boasts a variety great restaurants and bars, and shopping, most of which are within walking distance of the hotel. Here is a map of Uptown

RRF INTENDS THIS CONFERENCE TO BE AS GREEN AND ECO-FRIENDLY AS POSSIBLE AND WE HOPE EVERYONE WILL DO THEIR PART.

- Disposable paper and plastic supplies will not be used at coffee breaks and social events.

- Reduce, reuse, recycle. Please use the recycling receptacles found in your room and around the hotel conference rooms.

- The Albuquerque-based company that is printing the conference book has developed systems and supplier relationships that enable them to provide alternatives to chlorine-compound-processed papers and 100% petroleum-based inks.

- RRF plans to collect and reuse name tag holders and lanyards. At the end of the conference please look for the drop off box at the Registration Desk where you can drop off your name tag.

MESSAGE FROM THE DIVERSITY, EQUITY, AND INCLUSION COMMITTEE

The DEI Committee of RRF is excited to support diversity, equity, and inclusion in Albuquerque by supplying "Celebrate Diversity" ribbons to conference goers and co-hosting a lunch-time social with ECRRs!

Diversity keeps ecosystems healthy.

It is no different for human organizations.

The Raptor Research Foundation was formed in response to the human-caused decline of raptor species. We know that diversity is at the core of a healthy ecosystem, and it is no different in the human realm. Diversity encompassing but not limited to race, gender identity, age, religion, disability, social and economic status, ethnicity, and experience provides a broad array of knowledge, ideas, and strengths that make scientific inquiry and conservation better. Therefore, we are committed to making RRF a more inclusive, equitable, and diverse organization.

RAPTOR RESEARCH FOUNDATION MISSION STATEMENT

"The Raptor Research Foundation advances the science, conservation, and understanding of birds of prey."

AMERICANS WITH DISABILITIES ACT (ADA) STATEMENT

RRF is committed to providing any necessary support to attendees who require assistance to be able to fully experience our conference. If you need extra assistance of any kind at our conference, please speak with someone at the registration table.

LEGACY GIVING

Ensure RRF's Future –

Become a Legacy Member! The Raptor Research Foundation has created a new membership level--Legacy Member—to recognize those making a planned gift to RRF via will, retirement account, life insurance, or similar means. This elite status acknowledges the substantial contribution these members make to ensure RRF's future. Dedicating even 5% of your estate makes a huge difference to RRF. If you value the networking, comaraderie, and professional and personal growth that RRF provides, in addition to ensuring future understanding, appreciation, and conservation of raptors worldwide, please consider becoming a Legacy Member by including RRF in your estate plans.

Learn more at https://www.raptorresearchfoundation.org/give/ or contact:
Travis Booms, Legacy Manager (travisbooms@hotmail.com), or Rob Bierregaard (president@raptorresearchfoundation.org)

CODE OF CONDUCT

1.0 HUMAN INTERACTIONS

The Raptor Research Foundation hosts an annual conference to exchange and disseminate scientific information on birds of prey including ecology, behavior, evolution and conservation. Because effective exchange of ideas is best accomplished in a friendly and open environment, it is fundamental to ensure that conference attendees treat each other with courtesy and respect in all interactions, including face-to-face, written, or on a virtual or on-line platform. For this reason, RRF places special care and emphasis on provisioning and ensuring a safe, hospitable, and productive environment for everyone attending its annual meeting, and any other RRF-sponsored event, regardless of ethnicity, nationality, religion, physical ability, physical appearance, gender, age, or sexual orientation. We take this aspect of our mission very seriously and expect all conference attendees to behave courteously, respectfully, and professionally to each other, to RRF employees and representatives, to conference volunteers, exhibitors, and local meeting venue staff.

RRF expects conference attendees to be able to engage in open discussions free of discrimination, harassment, and retaliation. We strongly believe that a community where people feel uncomfortable, threatened, or under discriminatory scrutiny is neither healthy nor productive. Accordingly, RRF strictly prohibits any degree of intimidating, threatening, or harassing conduct during our conferences, as well as in any other written, on-line, or personal communication involving any activity of the Raptor Research Foundation. This policy applies to speakers, staff, volunteers, exhibitors, and attendees. RRF members or conference delegates violating these rules may be sanctioned, expelled from the conference, or expelled from RRF at the discretion of the RRF Board of Directors.

2.0 WILDLIFE INTERACTIONS

The RRF often hosts group events to migration stations, banding sites, national or state parks, and other sites of interests to count raptors, birdwatch, or otherwise enjoy nature. RRF supports passive enjoyment of the wildlife encountered on these trips; however, the safety and security of the wildlife with which we interact must take priority over our enjoyment. Thus, any form of wildlife harassment (defined below) during these recreational outings will not be tolerated during any RRF sponsored events.*

**Note this does not apply to conservation research that RRF members may conduct, and training-related events where broadcast calls and other forms of engagement with wildlife is permitted in a controlled and responsible manner.*

3.0 DEFINITIONS

Discrimination – Treatment or consideration of, or making a distinction in favor of or against, a person or thing based on the group, class, or category to which that person or thing belongs rather than on individual merit. Discrimination can be the effect of some law or established practice that confers privileges on a certain class or denies privileges to a certain class because of race, age, sex, nationality, religion, or handicap (https://definitions.uslegal.com/d/discrimination/).

HARASSMENT – A course of conduct which threatens, intimidates, alarms, or puts a person in fear of their safety. Harassment is unwanted, unwelcomed and uninvited behavior that demeans, threatens or offends the victim and results in a hostile environment for the victim. Harassing behavior may include, but is not limited to, epithets, derogatory comments or slurs and lewd propositions, assault, impeding or blocking movement, offensive touching or any physical interference with normal work or movement, and visual insults, such as derogatory posters or cartoons (https://definitions.uslegal.com/h/harassment/).

WILDLIFE HARASSMENT – to engage in any act which demonstrates a disregard for the well-being of wildlife or which creates the likelihood of injury to, or disrupts normal behavior patterns of wildlife, such as feeding, watering, resting, and breeding. Such acts include, but are not limited to, chasing, pursuing, herding, playing or mimicking alarm or other communication calls, or attempting to take wildlife.

4.0 REPORTING AN INCIDENT

Any RRF member or conference participant who believes that he or she has been subjected to a violation of the Code of Conduct, notices that someone else is being subjected to a violation of the Code of Conduct, or has any other concerns about the appropriateness or professionalism of an individual's behavior at any RRF-sponsored event should contact any member of the Code of Conduct Committee or RRF Board. He or she will not be required nor expected to discuss the concern with the person thought to have potentially violated the Raptor Research Foundation Code of Conduct. All allegations will be treated seriously and investigated during the RRF-sponsored event itself to the extent practical, or will be investigated as efficiently as possible thereafter. Confidentiality will be honored to the extent permitted as long as the rights of others are not compromised.

5.0 DISCIPLINARY ACTION

Individuals engaging in behavior prohibited by the RRF Code of Conduct will be subject to disciplinary action. RRF leadership may take any action they deem appropriate, ranging from a verbal warning to ejection from the meeting or activity in question without refund of registration fees, to expulsion from the Foundation in case of membership. Repeat offenders may be subject to further disciplinary action, such as being banned from participating in future meetings. Note that RRF has the authority within its Bylaws to terminate the membership of any member after fair and reasonable consideration all of the relevant facts and circumstances. Disciplinary action will apply to all offenders participating in the conference, from non-RRF members to Board of Directors.

6.0 RETALIATION IS PROHIBITED

RRF will not tolerate any form of retaliation or attempt at dissuasion against individuals who file a complaint or assist in the investigation, either by the original offender, or by any individual on his/her behalf, or by the Board member who receives the initial complaint. Retaliation is a serious violation of this policy and, like harassment or discrimination itself, will be subject to disciplinary action.

7.0 QUESTIONS & APPEAL

Any questions regarding this policy should be directed to the RRF Code of Conduct Committee Chair, RRF Board, or the local conference committee, which will re-direct it to the Board of Directors. In the event that an individual involved in any reported incident is dissatisfied with the disciplinary action, he or she may appeal to the RRF Board, which will privately discuss the issue and vote for a decision.

DEFINITIONS

Discrimination – Treatment or consideration of, or making a distinction in favor of or against, a person or thing based on the group, class, or category to which that person or thing belongs rather than on individual merit. Discrimination can be the effect of some law or established practice that confers privileges on a certain class or denies privileges to a certain class because of race, age, sex, nationality, religion, or handicap (https://definitions.uslegal.com/d/discrimination/). Harassment – A course of conduct which threatens, intimidates, alarms, or puts a person in fear of their safety. Harassment is unwanted, unwelcomed and uninvited behavior that demeans, threatens or offends the victim and results in a hostile environment for the victim. Harassing behavior may include, but is not limited to, epithets, derogatory comments or slurs and lewd propositions, assault, impeding or blocking movement, offensive touching or any physical interference with normal work or movement, and visual insults, such as derogatory posters or cartoons (https://definitions.uslegal.com/h/harassment/).

PLENARY SPEAKERS

Plenary speakers are scheduled for the first two mornings (Thursday and Friday) of the conference

Thursday October 19, 09:00 - 10:00
Scott Weidensaul, Project SNOWstorm's Studies of Snowy Owls: A Model for Collaborative, Crowd-funded Raptor Research

Thursday October 19, 10:30 - 12:00
Robert Mesta, Aimee Roberson, Tiana Williams-Claussen, Connecting Worlds: Indigenous World Views, Science, and Sovereignty in Raptor Research and Conservation

Friday October 20, 08:30 - 09:30
Dr. Patricia Kennedy, A 50-year Perspective on Conservation of Northern Goshawks

Project SNOWstorm's Studies of Snowy Owls: A Model for Collaborative, Crowd-funded Raptor Research

SCOTT WEIDENSAUL

Scott Weidensaul is the author of nearly 30 books on natural history, including the Pulitzer Prize finalist *Living on the Wind* (1999) and the New York Times bestseller *A World on the Wing* (2021), both about bird migration. He has directed a major Northern Saw-whet Owl banding project in Pennsylvania for more than 25 years, and co-directs Project Owlnet, a collaborative effort among more than 100 owl-banding sites in North America. He is a director of the Critical Connections project studying bird migration on national park lands in Alaska, has banded western hummingbirds in the East since 2001, and co-founded and helps direct Project SNOWstorm, which studies the winter ecology of Snowy Owls.

A 50-year Perspective on Conservation of Northern Goshawks

PATRICIA KENNEDY

Pat Kennedy is currently Professor Emeritus in the Department of Fisheries and Wildlife at Oregon State University (OSU). She has been affiliated with this department since she arrived at OSU in 2002. She recently retired from her position as Director of OSU's Eastern Oregon Agriculture & Natural Resource Program, which is OSU's campus in northeastern Oregon. Previously, she was an Associate Professor in the Department of Fish and Wildlife Biology at Colorado State University. Pat has studied a wide range of birds over the years, but her first love are raptors and in particular, she is enthralled with the Northern Goshawk. Pat has been a member of the Raptor Research Foundation since 1970 and was honored with the society's 2022 Hamerstrom Award for her contributions to raptor ecology and natural history. She hails from the south side of Chicago, but completed all of her academic training in the western US, where she has remained.

Connecting Worlds: Indigenous World Views, Science, and Sovereignty in Raptor Research and Conservation

ROBERT MESTA

Robert is a retired U.S. Fish and Wildlife Service ornithologist. He spent his professional career working to protect, conserve, and recover threatened and endangered North American bird populations. His area of expertise is the recovery of endangered birds of prey. He directed national and international-level programs to recover the California Condor, Bald Eagle, Peregrine Falcon, and the Masked Bobwhite Quail. Robert coordinated the California Condor Recovery Program from 1990 to 2000. In 1992, he directed the first reintroduction of captive-bred condors back to the wild in southern California, and in 1996, he led the successful release of condors into the Grand Canyon. In the 1980's Robert established the successful Arizona Bald Eagle Nest-Watch Program and was a member of the National Bald Eagle Recovery Team that down-listed the Bald Eagle from endangered to threatened, in 1995. As leader of the National Peregrine Falcon Recovery Team, he wrote the rule that removed the falcon from the Endangered Species List after its successful recovery. As leader of the Masked Bobwhite Quail Recovery Team Robert worked to establish a captive breeding program in Mexico to re-establish this endangered subspecies to its historical range in Mexico. From 1999 to 2015 he coordinated the Sonoran Joint Venture, a bi-national bird conservation program between the United States and Mexico. Currently, Robert directs the Liberty Wildlife Non-Eagle Feather Repository Program, a partnership with the U.S. Fish and Wildlife Service to accept, hold, and distribute non-eagle feathers to Native Americans for religious and ceremonial purposes.

AIMEE ROBERSON

Aimee Roberson is the Director of the Southwest Region for American Bird Conservancy. Previously, she served as the Coordinator for the Rio Grande Joint Venture, and prior to that worked for the U.S. Fish and Wildlife Service for many years. Aimee is a lifelong student of Earth's wisdom and holds degrees in geology (B.A.) and conservation biology (M.S.). She focused on raptor research early in her career, including studying and learning from Peregrine Falcons, Swallow-tailed Kites, various species of owls, and Northern Goshawks. Aimee is committed to reciprocity, community, and environmental stewardship, and partners with people and all our relations to ensure that native grasses grow and rivers continue to flow. Aimee provides leadership to conservation partnerships in the southwestern United States and northern Mexico — co-creating a vision; integrating cultural values and ecological knowledge with science for meaningful decision making; and implementing shared strategies for stewarding wildlife, water, and ecosystems. She currently serves on the boards of the Rio Grande Joint Venture, Sonoran Joint Venture, Big Bend Conservation Alliance, and Regalia Making Relatives. She is a citizen of the Choctaw Nation of Oklahoma and a descendant of the Chickasaw Nation. Aimee and her husband, Rawles, enjoy growing Indigenous foods, such as Chikashsha tanchi homma (Chickasaw red corn) and isito (Choctaw sweet potato squash).

TIANA WILLIAMS-CLAUSSEN

Tiana Williams-Claussen is a member of the Yurok Tribe and comes from the village of Wehl-kwew' on the Yurok Reservation, in California. She received her BA in Biochemical Sciences from Harvard University, returned to serve her tribe, and is currently pursuing a Master of Sciences in Natural Resources from California Polytechnic State University, Humboldt. Tiana's graduate work focuses on lessons learned and pathways forged for successful integration of federal, tribal, and state legislation in pursuit of restoration of California condor to Yurok Ancestral Territory, a goal attained in 2022 with release of eight condors into Yurok skies after 130 years' absence. Tiana relies on her native upbringing and formal education to bridge the beliefs, knowledge, and practices of the Yurok with those rooted in Western-science, and to work toward a cohesive, well-informed perspective on holistic ecosystem management. Instrumental to the formation of the Yurok Tribe Wildlife Department, she currently serves as Department Director.

SYMPOSIA

BURROWING OWLS

The Burrowing Owl symposium will bring together scientists from across the North American range of the Burrowing Owl to explore datasets that could contribute to one or more integrated population models (IPM) of the species to better understand population dynamics and causes of population declines. Speakers will present their datasets that could contribute to this collaborative effort. Datasets will include count data, survival data (adult and juvenile), nest survival and productivity. This symposium will include a half day of presentations and a half day closed meeting to plan the collaborative effort.

Organizer: Dr. Martha Desmond

ADVANCES IN RAPTOR HEALTH

The importance of wildlife health has become more striking lately, with the SARS-CoV-2 (COVID) pandemic and other zoonotic disease outbreaks around the world. Specifically, the health of raptors has gained attention, with disease fallout from catastrophic vulture declines, economic effects of the spread of highly pathogenic avian influenza (HPAI), the ongoing issue of lead toxicosis, and the emerging concern of anticoagulant rodenticide toxicosis. Although disease and toxicity may be the first things that come to mind in relation to "health," traumatic injuries come under this umbrella as well, and trauma is a leading cause of morbidity and mortality for birds of prey worldwide. While renewable energy development is critical for conservation, mortality of raptors and other birds from wind turbines is an increasing cause for concern. Building strikes, gunshot wounds, and other trauma are also major causes of injury for raptors. Efforts are being made by veterinarians, epidemiologists, wildlife biologists, wildlife rehabilitators, and many others to enhance the health of raptors at the individual, population, regional, and global levels. The goal of this symposium is to bring together a diverse group of researchers and clinicians who are working towards improving raptor health in various fields. There will be a focus on the ongoing North American outbreak of HPAI, including regional epidemiology and necropsy findings. Key topics in raptor health, such as rodenticide and lead toxicity, will be covered, as well as other issues of broad concern in the field. Non-clinical topics, such as the importance of partnerships and collaborative work, as well as communication channels and disease surveillance, will be included.

Organizer: Dr. Christine Fiorello, DVM, PhD, Dipl. ACZM

CONTEMPORARY ISSUES IN THE CONSERVATION AND MANAGEMENT OF NORTH AMERICAN RAPTORS

This symposium is based on the premise that a history of pesticide use, persecution, and land management practices resulted in birds of prey being a substantive conservation and management concern for state and federal agencies in the 1970 -1990s. During this period, the wildlife profession played a critical role in recovery and management of numerous raptor species, and many state and federal agencies even had dedicated raptor biologists employed to address these issues. Over the last two decades, however, attention to applied raptor conservation and management has declined within agencies. While attention continues to be given to some long-standing issues such as barred owl-spotted owl conflicts, and wind-energy conflicts, there appears to be a general impression that the 'big issues' having been resolved. This has been concurrent with a decline in funding and loss of dedicated raptor biologists in management agencies. Additionally, many current management practices and approaches are steeped in a history of recovery efforts for threatened or diminished raptor populations, which does not reflect that many contemporary raptor management issues are not due to scarcity but rather to that of abundance and the problems this creates, and to anthropogenic driven influences such as a changing climate. We suggest there is a need to raise awareness of contemporary challenges facing applied raptor conservation and management. The symposium will focus on four topic areas: a history of raptor management in North America, contemporary anthropogenic driven influences on raptor populations, climate driven issues impacting raptor populations, and applied management issues, many of which are driven by conflict and abundance of raptors.

Organizers: Dr. Clint Boal and Dr. Brent Bibles

FIRE RAPTOR INTERACTIONS: EMERGING SCIENCE FOR CONSERVATION IN THE PYROCENE

Anthropogenic influences on land-use and climate are driving rapid changes in fire regimes worldwide. The unanswered questions on management implications and ecological trade-offs in the face of this increased pressure are creating conservation challenges. The arid southwestern forests of the U.S. are at the forefront of this change-fire regimes are shifting from frequent and low intensity fires to large, homogeneous high intensity fires. Due to the increased wildfire risk to human communities, preventative fuel-reduction activities are a high priority for land managers. While fire is an important ecological driver of diversity, the influence of fire on raptors and other taxa, particularly in light of the changing climate, remains an understudied topic. Many raptors have evolved to be resilient to and even benefit from historical fire-regimes, yet the future footprint of fires has the potential to reach beyond their adaptive capacity. In this context, understanding the nuanced effects of fire on raptors is integral to balancing their future conservation alongside wildland fire mitigation. Our symposium highlights the latest scientific research on this topic, followed by a panel of experts discussing the needs and knowledge gaps that should lead future work.

Organizers: Marion Clement, M.S., Dr. Gavin Jones, Shaula Hedwall, M.S. and Dr. Marilyn Wright

SOCIAL EVENTS

ICEBREAKER
Wednesday evening, Oct. 18, 17:30-20:00
Rooms: Pecos/Sandia/Acoma

ECRR/DEI RECEPTION*
Thursday lunch Oct 19, 12:00 to 14:00
Rooms: Cimmaron/Las Cruces

POSTER SESSION
Thursday evening, Oct 19, 17:30-19:30
Rooms: Pecos/Sandia/Acoma

DINNER/ENTERTAINMENT*
Friday at the Indian Pueblo Cultural Center
Buses will leave the hotel at 17:30

SATURDAY NIGHT COCKTAIL HOUR
Oct. 21, 17:30-18:30 pm in the foyer/conference area

SATURDAY NIGHT BANQUET*
Oct. 21, 18:30-21:00
Rooms: Pecos/Sandia/Acoma

**Event for ticketed registrants only.*

DINNER/ENTERTAINMENT EVENT FRIDAY OCT 20. 18:00-21:00

This event, on Friday October 20, will be at the Indian Pueblo Cultural Center. Included is a buffet of native foods and a native dance troupe that will perform traditional dances. The museum and native arts store are excellent as well.

FIELD TRIPS

VALLES CALDERA NATIONAL PRESERVE FULL DAY

Wednesday, Oct. 18, 2023
7:00 – 17:00

About 1.25 million years ago, a spectacular volcanic eruption created the 13-mile wide circular depression now known as the Valles Caldera. The preserve is known for its huge mountain meadows, abundant wildlife, and meandering streams. The area also preserves the homeland of ancestral native peoples and embraces a rich human history. Dr. Robert Parmenter, Division Chief, Science & Resource Stewardship, will guide our tour throughout the caldera. Boxed lunch provided.

Vans will leave the hotel at 7:00 am

BANDELIER NATIONAL MONUMENT FULL DAY

Wednesday, Oct. 18, 2023
7:00 – 17:00

Bandelier National Monument protects over 33,000 acres of rugged but beautiful canyon and mesa country as well as evidence of a human presence here going back over 11,000 years. Petroglyphs, dwellings carved into the soft rock cliffs, and standing masonry walls pay tribute to the early days of a culture that still survives in the surrounding communities. Walk the short loop trails, which pass along many ruins, visit the waterfalls, or climb ladders 140 ft up to the Alcove House for a spectacular view of Frijoles Canyon. A cafe adjacent to the Visitor Center is available for lunch, coffee, and snacks.

Vans will leave the hotel at 7:00 am

VALLE DE ORO NATIONAL WILDLIFE REFUGE
HALF DAY

Tuesday, Oct. 17, 2023
8:00 – 12:00

Valle de Oro National Wildlife Refuge acknowledges that it occupies over 570 acres of ancestral, traditional, and contemporary lands of the Tiwa People. The Tiwa people have stewarded these lands for generations, and in the case of the refuge continue to play a vital role in its protection, restoration, and prosperity. Just a few miles south of Albuquerque, Valle de Oro works with community partners to reconnect people, especially young people, to the natural world, and as such, is a designated Urban National Wildlife Refuge. Long-term plans are to make the refuge into a mosaic of native Middle Rio Grande Valley habitats and an oasis for both wildlife and people. Habitats already provide a crucial stopping point for birds migrating along the Rio Grande flyway.

RIO GRANDE NATURE CENTER STATE PARK
HALF DAY

Tuesday, Oct. 17, 2023 7:15 – 12:00

Located on the Rio Grande flyway, the park offers excellent birdwatching opportunities throughout the year. There are indoor and outdoor wildlife viewing areas overlooking ponds, a native plant garden, and a pollinator garden, as well as trails to the Rio Grande and Bosque. The Visitor Center offers informative displays and a unique Nature Shop.

WORKSHOPS

RRF WILL HOST A DAY OF WORKSHOPS ON WEDNESDAY, 18 OCTOBER 2023.

ADVANCED MOLT AND AGING IN RAPTORS

Instructors: Jesse Watson, Nicole Richardson, Andrew Johnson

Time: 08:00-12:00
Carlsbad Room

Molt is a necessary, yet costly stage in the annual cycle of a raptor. Because of this, detailed molt data can be a powerful research tool. In this workshop we will describe the process of molt in raptors. The first part of the workshop will focus on learning the basics of molt, from terminology and bird topography, to molt nodes and sequence. From this foundation, we will then discuss how to use this knowledge in determining the age of birds, both from photos of free-flying wild birds, as well as birds in the hand. In the second part of the workshop, we will put this knowledge to use with photos, as well as spread wings from museum specimens. Participants will come away with a greater understanding of molt and its use in raptor research

NECROPSY, HANDLING, AND TAKING BIOMEDICAL SAMPLES IN RAPTORS

Instructors: Christine Fiorello, Nicole Nemeth

Time: 08:00-12:00
Las Cruces Room

Intended for all those who handle birds of prey, both in the field and in captivity, and who need to take biomedical samples from live and dead birds. You will learn how to properly handle and secure the birds – a skill critical to taking quality biomedical samples while avoiding accidents and injuries, which can sometimes be severe if these procedures are not performed correctly. Methods and techniques for collecting a wide range of biomedical samples will be presented and discussed.

HARNESSING RAPTORS WITH TRANSMITTERS

Instructors: Tricia Miller, Vincent Slabe, Mike Lanzone

Time: 08:00-12:00
Santa Fe Room

This class will cover the process of attaching transmitters (either VHF, satellite, or GSM) to raptors, from initial thoughts of the bird's welfare to specifics of making backpack harnesses and attaching telemetry units to birds. We will discuss and demonstrate several different options and methods for making harnesses, different attachment techniques (e.g., tail-mount, patagial), and types of transmitters. The majority of the class will be hands-on, using a backpack harness to attach a transmitter to carcasses of different-sized raptors.

TECHNIQUES FOR HANDLING, AUXILIARY MARKING, AND MEASURING RAPTORS AFTER CAPTURE

Instructors: John Smallwood, Teresa Ely, Laura Echávez

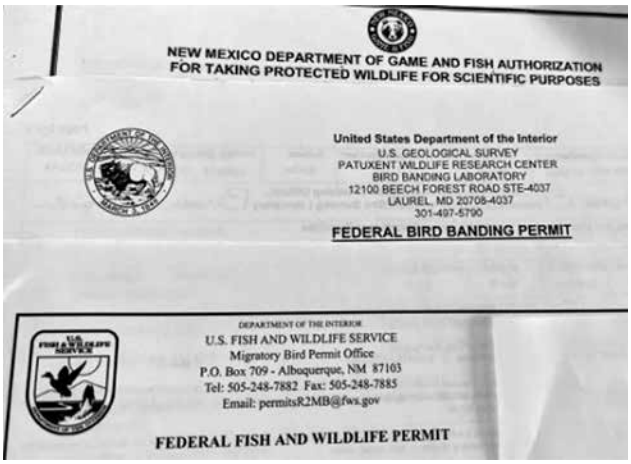
Time: 13:00-17:00
Carlsbad Room

This course will give students hands-on experience in applying the following types of auxiliary markers to raptors: butt-end and lock-on U.S. Geological Survey leg bands, patagial markers for small and large raptors, and feathers (through feather imping). Students will also have the opportunity to learn and practice proper handling techniques.

ALL ABOUT PERMITS – U.S. PERMIT TYPES AND REQUIREMENTS FOR RAPTOR STUDIES AND MANAGEMENT

Instructors: Kristin Madden, Brian Millsap, Kirsten McDonnell, Jennifer Davis, Antonio Celis-Murillo

Time: 13:00-17:00
Las Cruces Room


NEW MEXICO DEPARTMENT OF GAME AND FISH AUTHORIZATION
FOR TAKING PROTECTED WILDLIFE FOR SCIENTIFIC PURPOSES

United States Department of the Interior
U.S. GEOLOGICAL SURVEY
PATUXENT WILDLIFE RESEARCH CENTER
BIRD BANDING LABORATORY
12100 BEECH FOREST ROAD STE-4037
LAUREL, MD 20708-4037
301-497-5790

FEDERAL BIRD BANDING PERMIT

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
Migratory Bird Permit Office
P.O. Box 709 - Albuquerque, NM 87103
Tel: 505-248-7882 Fax: 505-248-7885
Email: permitsR2MB@fws.gov

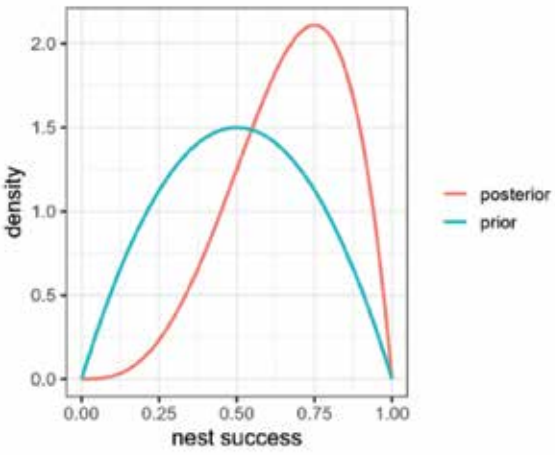
FEDERAL FISH AND WILDLIFE PERMIT

This course will provide participants with an overview of the types of federal and state permits that may be required when studying or working with raptors, as well as the general requirements and procedures for obtaining the necessary authorizations. The course will also cover general requirements and procedures for obtaining necessary Institutional Animal Care and Use Committee (IACUC) approvals for research projects involving raptors. Although specific requirements for permits and IACUC authorizations will vary among states and institutions, participants in this workshop will gain enough background to know when a permit or IACUC approval might be required, what type of authorization they may need to obtain, and the background training and application procedures that might be required to obtain the necessary approvals.

FUNDAMENTALS OF BAYESIAN MODELING

Instructor: Joseph Eisaguirre

Time: 13:00-17:00
Santa Fe Room



Software, such as JAGS, Stan, and NIMBLE, along with tons of code available on the internet and elsewhere, have made fitting complex Bayesian hierarchical models to data easier. However, applying these models and correctly interpreting the results still require a solid foundation in the fundamentals of Bayesian statistics. This course will not focus on a particular type of analysis, but rather will cover some fundamentals of Bayesian modeling, including the basics of Bayesian inference, priors and how to choose them, conjugacy, fitting models to data, and some general hierarchical models. We will dive into Markov chain Monte Carlo (MCMC), including how to code simple MCMC algorithms from scratch in R, as well as how to use software, such as JAGS and Stan. We will apply some basic nest success and resource selection models (and possibly others) to raptor data as motivating examples. If you'd like to follow along and run code, a laptop with R, Rstudio, JAGS, and Stan (and possibly NIMBLE) installed is recommended. The material will primarily be geared toward graduate students and other researchers that have experience or have had coursework in applied statistics or biometrics and using R for data analysis, including (generalized) linear modeling or other frequentist approaches, but are interested in learning what Bayesian statistics is all about.

ABSTRACTS

SYMPOSIA PRESENTATIONS

S01

What are integrated population models and how might they contribute to Burrowing Owl conservation?

Brian Millsap[1], Paige Howell[2], Martha Desmond[1], Fitsum Abadi[1]

[1]*New Mexico State University, Department of Fish, Wildlife, and Conservation Ecology, Las Cruces, NM, USA.* [2]*U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Hadley, MA, USA.*

The purpose of the symposium on Burrowing Owls (*Athene cunicularia*) at the 2023 Raptor Research Foundation annual conference is to assess whether sufficient data exist to develop one or more Integrated Population Models (IPMs) for this owl in the United States. This talk provides a brief overview and introduction to IPMs. IPMs formally combine information from count and demographic data to produce estimates of vital rates and population size with full uncertainty. The advantage of IPMs is that they can improve the precision of estimates of demographic rates, and under some circumstances allow estimation of latent parameters for which there are no direct data (e.g. immigration rates, probability of breeding). Such a model or models for the Burrowing Owl could improve understanding of population trajectory, but also help to identify the demographic drivers of population change at various spatial scales. The objectives of this talk are to: (1) introduce integrated population models and their construction; (2) review several recent integrated population models for raptors in the United States and what they have revealed; and (3) describe some of the large-scale data sets that could be incorporated into a Burrowing Owl IPM to augment local data, focusing on the Bird Banding Laboratory's band recovery database as an example.

S02

Burrowing Owl demography and nesting ecology in San Diego County, California, USA

Colleen L Wisinski, Susanne Marczak, Melissa Merrick, Ronald R Swaisgood

San Diego Zoo Wildlife Alliance, Escondido, CA, USA.

The Western Burrowing Owl (BUOW, *Athene cunicularia hypugaea*) - a California species of special concern - has experienced range-wide declines, including in San Diego County where only one breeding population remained by the 2010s. Since 2013, we have monitored between 17 and 44 breeding burrows per year, and captured and banded over 800 BUOW, providing valuable information regarding survivorship of adults and juveniles, nest success, and productivity. Through our monitoring and research efforts over 10 years (2013-2022), we have found that all of these demographic parameters are highly variable across years, which may affect long-term population stability in the region. Apparent annual adult survival ranged from 35-83%, juvenile survival (from banding to second year) ranged from 10-55%, and the proportion of emerged juveniles that survived to fledging (45 days of age) ranged from 36-91%. We used three years of these local demographic data to conduct a population viability analysis (PVA) to better understand factors driving population growth in San Diego County and found the population may be functioning as a sink. We plan to update the PVA with 10 years' worth of data. Using blood samples collected during 2013-2015, we conducted a small-scale genetic analysis to understand brood sex ratios and measures of population health such as inbreeding. Additionally, data we have gathered using remote cameras at nest burrows can inform factors contributing to mortality such as predation and infanticide. We will discuss how our datasets and the results from the PVA could all contribute to an integrated population model for BUOW.

S03

Population trends in an urban, resident Burrowing Owl population in northern California

Lynne A Trulio[1], Debra A Chromczak[2]

[1]*San Jose State University, San Jose, CA, USA.*
[2]*Burrowing Owl Researcher & Consultant, Riegelsville, PA, USA.*

The Burrowing Owl (*Athene cunicularia*) is declining throughout much of its range and, in some locations, declines are occurring in urban settings. We studied population parameters and change over time in the resident, breeding population of Western Burrowing Owls (*A. c. hypygaea*) in urban Santa Clara County, California, at the south end of the San Francisco Bay. From 1999-2019, we collected data on population numbers and reproductive success, and we banded as many adults and juveniles as possible each year.

Analysis of data from 1999-2003 indicated adult survivorship (N=218) ranged from 0.519±0.036 to 0.549±0.042 and juvenile survivorship (N=127) was 0.366±0.039, with a population growth rate less than one (0.896; 95% CI=0.895, 0.897). The number of breeding adults declined from approximately 128 to 84 during that period. Despite this decline, the number of successful nests was relatively stable, ranging between 22 and 28 nests; the average number of emergent chicks per brood fluctuated between approximately 2.5 and 4. Numbers of breeding adults continued to decline and, by 2019, only 33 adults were recorded in the population. Data from this population can be analyzed for population parameters such as adult and juvenile survivorship and reproductive success (percent of successful nests, number of chicks per emergent brood). We will discuss how data from this urban, resident population might be incorporated into an integrated population model for Burrowing Owls to aid in their range-wide conservation.

S04

Extirpation of Orange County, California breeding Burrowing Owl population: the convergence of philopatry, habitat fragmentation, and Allee effects

Peter H Bloom

Bloom Research, Inc., Santa Ana, CA, USA.

As early as 1898 and over the last 12 decades, the status of the Burrowing Owl (*Athene cunicularia*) in coastal southern California and particularly Orange County was well documented. The earliest reports considered the species abundant along the south coastal slope, but starting around 1931 the breeding population slipped into a noticeable decline that continued until 2014, when the last known breeding attempt in Orange County occurred. Publications and reports from 1931-2016 have documented a chronic, but slow trend toward extirpation of the breeding population of coastal southern California from Santa Barbara County south through northern San Diego County. On the south coastal slope, only in southern San Diego County does a remnant breeding population exist. Causes of the Orange County decline include habitat loss, degradation, and fragmentation. California ground squirrel (*Otospermophilus beecheyi*) eradication, and coastal predator management at California Least Tern (*Sterna antillarum browni*) and Western Snowy Plover (*Charadrius nivosus*) nesting colonies are also influencing breeding populations of Burrowing Owls in the region. The impact of these factors was compounded by short natal and breeding dispersal distances and ultimately by Allee effects. This report documents the last known nesting attempts of Burrowing Owls in Orange County, California. Although it remains plausible that an occasional future nesting attempt may still occur, the species in Orange County, as well as nesting colonies in other coastal southern California counties, can now be regarded as ecologically extinct.

S05

Burrowing Owl survival, nest survival and productivity in anthropogenic habitats of the American Southwest

Martha Desmond[1], Dejeanne Doublet[2], Savannah FinchNew[2], Eboni Griffin[2], David H Johnson[3], Fitsum Abadi[2]

[1]Las Cruces, Las Cruces, NM, USA. [2]New Mexico State University, Las Cruces, NM, USA. [3]Global Owl Project, Alexandria, VA, USA.

The Burrowing Owl (*Athene cunicularia*) is a species of concern in North America that is often found in anthropogenic habitats. We report on adult and juvenile survival, nest survival and productivity in urban and agricultural habitats of the southwest. In Arizona, adult Burrowing Owls (N=42) had similar annual survival for 2017 (0.68, 95% CI=0.45, 0.92) and 2018 (0.69, 95% CI=0.47, 0.90). Burrowing Owls at Arizona sites had higher cumulative nest survival (CNS; N=58 nests) in 2017 (CNS=0.83, 95% CI=0.71, 0.94) compared to 2018 (CNS=0.68, 95% CI=0.50, 0.87). These nests produced an average of 2.4 fledglings per nest. These results are similar to estimates of adult survival and nest survival in other urban and agricultural systems. In New Mexico, juvenile post-fledging survival was greater in landscapes with a greater percentage of agriculture (β=0.017, 95% CI=0.17, 0.018). Post-fledging survival was greatest in agriculture (91%) followed by urban (67%) and greenspace (50%) environments. Increased mortality in greenspace suggests urban parks and patches of native vegetation adjacent to urban development do not protect young owls. Owls in larger expanses of continuous cover (agriculture) had greater movements and utilized more satellite burrows. We will discuss how Burrowing Owl survival, nest survival and productivity in the American Southwest compares with datasets from other anthropogenic and native habitats.

S06

Results of a 15-year Burrowing Owl demographic study in north-central Oregon

David H Johnson

Global Owl Project, Alexandria, VA, USA.

Due to the elimination of American badgers (*Taxidea taxus*), Western Burrowing Owls (*Athene cunicularia hypugaea*) on the Umatilla Army Depot (Depot) declined to three-four nesting pairs as of 2008. Artificial burrows were added to rescue the population, with numbers growing to 9, 21, 37, and 45 pairs in 2009, 2010, 2011, and 2012, respectively. While fluctuating, an average of 53 nesting pairs were recorded annually for 2013-2022. Essentially all adult and young owls were captured each year, with a total of 2,800 individual owls banded. A total of 608 nesting attempts were followed to determine clutch sizes, hatch date, number of young, and localized breeding dispersal

of adults. Higher reproduction occurred during seasons with limited rainfall and shorter vegetation height (<15 cm). While migratory, owl return rates were high: 85% of adult males and 75% of adult females were banded from a prior year. Age structure found the oldest owls reaching seven and eight years of age. Banding and morphology data indicated that females selected males of similar age and physical size. Emigration and immigration indicated owls moving within the Oregon-Washington(WA)-British Columbia region. Migration of owls from the Depot found females wintering in California (CA) or Nevada; some males also wintered in CA, while the majority of males wintered in east-central WA. I will discuss how these data can contribute to an integrated population model for Burrowing Owls.

S07

Demographic data from Burrowing Owls in Idaho for integrated population modeling

Jim Belthoff

Boise State University, Boise, ID, USA.

Between 1994 and 2023, we have gathered demographic data from a primarily migratory population of Burrowing Owls (*Athene cunicularia*) in the Morley Nelson Snake River Birds of Prey National Conservation Area, located in southwestern Idaho. Nesting Burrowing Owls in this area make use of both natural and artificial burrows, but our best demographic information comes from those nesting in artificial burrows where we can count eggs, record hatching dates, and capture nestlings and adults. Almost 6,000 individuals have been captured and individually marked, with more than 900 nests monitored for reproductive success and productivity. Putative progeny and parents have been organized into a pedigree to elucidate kinship, approximately 1,200 nestlings during a seven-year window were genetically sexed to understand sex ratio variation, and correlates of lifetime reproductive success have been analyzed. These and similar data are available to assist with integrated population modeling of North American Burrowing Owls.

S08

Latitudinal patterns in survival, fecundity, migration, dispersal, and fidelity of Burrowing Owls in North America

Courtney J Conway[1], Carl G Lundblad[2], Anthony J Locatelli[3]

[1]US Geological Survey-Idaho Coop Unit, Moscow, ID, USA. [2]US Geological Survey, Reno, NV, USA. [3]University of Idaho, Moscow, ID, USA.

Western Burrowing Owls (*Athene cunicularia hypugaea*) have declined in some portions of their breeding range but appear to be relatively stable in other regions. Moreover, breeding densities are very low in most of their breeding range and their distribution is patchy. Understanding the factors that influence geographic variation in demographic traits and life history strategies can help determine the likely causes of population declines and why they vary regionally. Elucidating the underlying cause(s) of this variation is especially important because Burrowing Owls are a species of national conservation concern in the United States and are federally endangered in Canada. Summarizing this information range-wide can potentially help inform efforts to create integrated population models. We have measured demographic traits of individually marked Burrowing Owls at study sites in seven states (WA, ID, WY, UT, AZ, NM, CA) over the past 25 years (1998-2023). We have collected intensive data to quantify nest survival and productivity, VHF telemetry data on juvenile survival and natal dispersal initiation, satellite telemetry data on adult survival, mark-resight and mark-recapture data on adults and juveniles, and migration and dispersal of adults via satellite telemetry. We will also present range-wide variation in the primary excavator of their nest burrows – information that can potentially affect or explain range-wide patterns in demographic traits. Our results show latitudinal and longitudinal patterns in many of these traits, and we will discuss how they may inform range-wide integrated population models (IPMs), as well as the limitations of our data for informing IPMs.

S09

Burrowing Owl population trends, nest survival and productivity across Great Plains grasslands

Martha Desmond[1], Jordan Ellison[2], Jennifer Davis[3], Julie Savidge[4], Nancy Hernandez[5], Charles Britt[6], Fitsum Abadi Gebreselassie[2]

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The Burrowing Owl (*Athene cunicularia*) is a species of concern in North America with pronounced declines across the Great Plains where they primarily nest in black-tailed prairie dog (*Cynomys ludovicianus*) colonies. Using a data set (N>1,200 nests) that spans seven breeding sites from South Dakota to northern Mexico in various years during 1989-2017 we examined factors that influenced population trends, nest survival and productivity of Burrowing Owls. In Nebraska we observed a 63% decline in Burrowing Owl populations across 17 black-tailed prairie dog colonies (1990-1996) linked to changes in active prairie dog burrow densities. We will present data on population counts across 72 Great Plains colonies across five years (2006-2010). Clutch size ranged from three to ten eggs with slightly smaller clutches in the southern plains. Nest survival and productivity (number of young surviving to 35 days of age) differed among study sites and years. Nest failure

ranged from 23-60% with predation being the main cause of failure. The North American badger (*Taxidea taxus*) was the primary predator however, snake predation also appeared to be strong. In general, we found nest survival increased with nest age, measures of prairie dog activity and the success of the nearest neighboring nest. Productivity varied by site and increased with measures of prairie dog activity and the success of the nearest neighboring nest. We will discuss how these data across Great Plains grasslands and other similar data sets can contribute to an integrated population model for Burrowing Owls.

S10

The history of raptor conservation and management in North America

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Establishment of the Hawk Mountain Sanctuary in 1934 marked the beginning of raptor protection in North America. Despite the ban on shooting raptors at the sanctuary, persecution continued to be widespread in other areas for the next 35 years. Peregrine Falcon (*Falco peregrinus*) and Bald Eagle (*Haliaeetus leucocephalus*) populations suffered serious declines associated with pesticide use. In 1972, DDT was banned, and an amendment to the Migratory Bird Act protected hawks, owls, eagles, and falcons. The 1970's saw a surge in raptor research and management. Falconers mobilized to refine and develop techniques for population augmentation in a successful attempt to reverse the Peregrine Falcon's population decline. Similar techniques were used to recover Bald Eagles and California Condors (*Gymnogyps californianus*). Throughout the continent, people provided artificial nest structures and perches for a variety of raptor species. Sanctuaries for raptors became established on public and private lands throughout North America. Research also addressed raptor depredation on livestock. By 1980, utility companies were working to reduce electrocution of raptors on power poles. Biologists, managers, and industry officials have collaborated to prevent raptor mortality from collisions at wind farms and airports, and they have tried to reduce exposure to organophosphates and lead. Agencies began including raptors in their land management plans, including disturbance buffer zones around nests. The most controversial landscape-scale raptor habitat protection involved the Northern Spotted Owl (*Strix occidentalis*). Raptor managers face continuing issues as well as emerging threats like illegal shooting, recreation impacts, invasive species, and climate change.

S11

Raptor electrocutions – impacts and mitigation

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Power lines are expanding globally and animal electrocutions are a continuing issue. It is estimated between 0.9 and 11.6 million birds are killed annually by electrocution in the United States. The United States Fish and Wildlife Service estimates 504 Golden Eagles (*Aquila chrysaetos*) are electrocuted annually in North America. Animal electrocutions can lead to electrical outages, fires, damaged equipment, and negative publicity. Because 1,024 species of birds are protected by federal law, electrocutions may also result in fines. Raptor electrocutions persist even though development of retrofitting solutions began decades ago. Three factors hamper retrofitting efforts in North America. First, the considerable number of poles with dangerous configurations located in raptor habitats has precluded addressing all dangerous poles. Second, some utilities only retrofit poles in response to an electrocution incident. Since a small portion of electrocutions trigger an outage, dangerous poles can persist undetected, even after killing a bird. Third, mitigation errors allow risk to persist on some poles even after retrofitting. Proper mitigation is done using separation, insulation and isolation. Separation involves building lines with adequate clearances to accommodate animals of concern. Insulation consists of adding various products such as bushing covers and insulated line hose. Isolation involves using barriers to prevent animal access to equipment. A successful avian program includes developing an Avian Protection Plan and building new facilities and retrofitting existing poles to accommodate animals. Fortunately solutions exist to mitigate electrocutions and these lessons are being extended to rural electrification programs in other parts of the world.

S12

A review of renewable energy impacts and mitigation for raptors

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Renewable energy developments can affect raptors directly, by killing or injuring them, or indirectly, by altering habitat or displacing birds from an area. These effects have potential to alter demography, although such effects are poorly known as there are few assessments of population level changes for raptor populations. Raptors are affected by both wind and solar energy developments; however, research and management of effects of renewable energy have focused primarily on collisions of

large soaring raptors with blades of wind turbines. Research has included describing spatio-temporal patterns in raptor strikes with turbines, evaluating fatality rates under a variety of settings, understanding how raptor habitat use overlaps with wind turbines, and modeling risk of raptor-turbine strikes. Such research can be applied to minimize turbine strikes during planning phases of development by siting turbines where strike risk for raptors is minimized. Research has the potential to be incorporated into artificial-intelligence systems designed to curtail existing turbines when collision risk is high. We also review mitigation efforts for raptors in North America and elsewhere. In the USA, mitigation has taken the form of reducing another type of anthropogenic mortality to compensate for raptors killed by collisions with wind turbines. Managing effects of renewable energy to raptors in the USA can be affected by the time and effort required of regulatory agencies to both enforce violations of existing laws and to approve mitigation measures.

S13

Understanding toxicants that influence raptors: monitoring, analysis, physiological and demographic consequences

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Raptors are apex predators and, often, indicators of the condition of the environment. Because of their trophic position, raptors are exposed to a large number of toxicants. Furthermore, because of the interest in the taxon and their ecological role, there have been a large number of studies on these species. Here, we review the ecological role raptors play and discuss why they are useful indicators of the condition of the environment, we discuss the five most common toxicant groups that are known to influence raptors globally: polychlorinated biphenyls, metals, organochlorine insecticides, flame retardants, and anticoagulant rodenticides, and we identify mechanisms for monitoring and analyzing exposure to each of those toxicants. Subsequently, we perform a meta-analysis to understand which toxicants 1) are relevant to the largest number of species, 2) have lethal vs. sublethal effects on individuals, 3) appear to have the greatest demographic effects, and 4) present the greatest unknowns relevant to future study. We developed a predictive model to identify poorly studied species predicted to be toxicant-exposed. Finally, we conclude with lessons learned from this review, focusing especially on knowledge gaps that may be useful for subsequent study and potential approaches to that study.

S14

Collisions between raptors and aircraft: a growing issue in the airport environment?

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Wildlife-aircraft collisions (wildlife strikes) pose a serious safety risk to the flying public. The total cost of wildlife strikes to commercial aviation world-wide has been estimated to be >USD $1.5 billion per year. Raptors are one of the most frequently struck bird guilds in the USA. For example, Red-tailed Hawks (*Buteo jamaicensis*) are one of the most abundant and wide-spread raptors in North America and are commonly involved in collisions with aircraft, thus posing an important risk to aviation safety. A recent study found among the 79 bird species evaluated, Red-tailed Hawks posed the highest economic strike risk to civil aviation in the USA. Additionally, Bald Eagles (*Haliaeetus leucocephalus*) have repopulated the majority of this species' historic range in the lower 48 states. Given this expansion and continued population growth, the frequency of human-eagle conflicts is growing by over 1,500%. Even smaller raptors, such as American Kestrels (*Falco sparverius*), can be problematic within airport environments. Management decisions on specific methods and practices to reduce the presence of raptors within airport environments involves a complex set of biological and social variables (e.g. the biology and legal status of the species involved, direct economic costs of management actions, hidden logistical costs, personal and corporate liability of bird strikes, and public perception of the management program in an increasingly social media-focused world). An important area of future research involves the development and evaluation of science-based effective, publicly acceptable methods of reducing raptor-human conflicts, especially situations involving human health and safety.

S15

Impact of wildfire on raptor communities

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Ecosystems are naturally dynamic and have associated disturbance regimes to which species have become adapted over long periods of evolutionary time. But rapid changes in climate and human land-use intensity have caused widespread disruptions to natural disturbance regimes. How might wildlife respond to novel disturbances? Here, we review the literature on the impacts of wildfire on raptor communities, highlighting aspects of their responses that are associated with altered disturbance regimes. In addition to reviewing the literature, we identify knowledge gaps and needs for future research, as well as propose recommendations based on the existing science to conserve raptors in the face of changing fire regimes.

S16

Climate change and migration of raptors

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Raptor migration has been monitored at hawkwatches across the globe since the 1930s. These data provide a rich resource in examining climate change impacts on raptor migration. Changes in migratory behavior in raptors, influenced by climate change, has been studied in a wide range of raptor species globally. Species or populations of species have changed their migratory behavior in three notable ways: change in migration timing, shortened migration distance, and shifts in regional distribution. Short-distance migrants appear to show more definitive shifts in migration behavior, however some long-distance migrants also show a possible response as well. Here we review key research regarding changes in raptor migration patterns and behavior, and review implications of these changes on raptor populations, migration monitoring, and topics for further research.

S17

Climate change and raptors occupying North American arid lands

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The arid lands of North America harbor a diverse assemblage of raptors. In particular, the warm deserts of American Southwest, due to geography and topography, harbor 66% of North American raptor species as breeders and 87% of North American species occur regularly during the year. This region also is "climate-challenged" due to recent and projected changes in climate. The region is warming, the precipitation regime is increasingly variable with droughts and extreme fire weather becoming more frequent and severe. In combination with anthropogenic impacts, these changes are creating substantial changes in land cover and water availability. Species in this region live near their physiological tolerances, as evidenced by the 27 species of breeding raptors that occur within the area being at the periphery of their range either geographically or altitudinally. Climate-driven changes may exceed some current breeding raptors physiological tolerances and will substantively reduce prey and nesting habitat for several species, while also potentially leading to expansions of other raptors. In addition, we can expect shifts in phenology of these species which has already been observed by the year-round presence of some species formerly only occurring as breeding residents. Managers can expect to see considerable changes in distribution and abundance of raptors in this region, with current species of concern likely becoming more challenging to conserve, as well as the need for management of new or currently peripheral raptor species. Importantly, urban environments in the region may also become important in the persistence of some species.

S18

How will raptors respond to a rapidly warming Arctic?

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The Arctic is warming two to four times faster than most other regions of Earth. Many changes associated with this warming, including those not anticipated by scientists and others, are occurring at unprecedented rates and will have both short- and long-term effects on the region and everything that lives here. The Intergovernmental Panel on Climate Change (IPCC)'s 2021 Sixth Assessment reported that some ongoing changes in the Arctic (e.g. sea ice loss, melting glaciers, thawing permafrost) are potentially irreversible on human time scales. Furthermore, some changes in the Arctic (e.g. sea ice loss, stratospheric polar vortex disruption) impact regional climates outside the Arctic. The rapid warming has raised concerns about ecological regime shifts, loss of ecosystem functions, and the potential collapse of Arctic and alpine ecosystems. Some of the ongoing changes in the Arctic that may directly or indirectly impact raptors include more extreme weather events, extended periods of high temperatures, rapid expansion of trees and shrubs, collapse of nesting substrate, increased frequency and intensity of wildfires, changes in prey distribution and abundance, and increased exposure to diseases and parasites. Furthermore, many raptors species that nest in the Arctic are migratory and are exposed to a cascade of effects resulting from a rapidly warming climate across their year-round range. The rapidity of the concurrent and interacting changes associated with rapid warming creates a challenging situation for understanding how raptors will respond to a rapidly changing climate in the Arctic and elsewhere.

S19

Real and perceived conflicts associated with raptor population increases

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Throughout the 1800s and 1900s, raptors in North America where often considered creatures of remote and wild places, intolerant of human presence and activities. Subsequent to protection under the Migratory Bird Treaty Act in 1972, it was realized these perceptions where less due to behavioral intolerances by raptors than to decades of persecution and more recent impacts of environmental contaminants. The success of many conservation efforts has resulted in many raptor species populations increasing and expanding. This has resulted in conflicts between raptors and human interests and

concerns. These may be ecological conflicts, such as situations in which increased abundance of a given raptor species may result in a disproportionate rate of predation on native species populations, increased predation on species of conservation concern, or competition with other raptor species. It can also consist of economic and sociological conflicts, such as increased depredations to aquaculture, livestock, and game animals, damage to objects and structures, aggression toward people, and bird-aircraft strike hazards. Conflicts may be perceived but with little evidential support, or real but ranging from negligible to substantive impacts. I will provide an overview of the most pressing contemporary conflicts, discuss the implications of real and perceived impacts, and suggest approaches to addressing the conflicts.

S20

Assessment of falconry take on raptor populations

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Falconry is the sport of hunting wild quarry with trained raptors. Regulations promulgated under the Migratory Bird Treaty Act recognize falconry as a legitimate use of raptors in the United States (USA), and the U.S. Fish and Wildlife Service (Service) has established regulations to ensure the removal of raptors from the wild (i.e. take) for use in the sport is sustainable. Detailed information on population size and demography for most raptors is unavailable, consequently the Service established biologically conservative annual take limits that indirectly account for this uncertainty. Typically, falconry take is limited to individuals less than one-year old, and overall allowable take limits are set at 5% of the estimated first-year age class. For most species, these allowable take limits equate to <1.5% of the total population size. A few species of raptors for which falconry take is authorized require special consideration, and for these species the Service conducts species-specific assessments. One such species is the Peregrine Falcon (*Falco peregrinus*), some North American populations of which were listed under the Endangered Species Act until 1999. The Service authorized limited falconry take of Peregrine Falcons starting in 2008, and recently completed a reassessment of the species' status and capacity to withstand take using integrated population models and prescribed take limit models. These analyses suggest that maximum sustainable yield for North American Peregrine Falcons would be a take rate of ~11% for all age classes, substantially greater than the maximum of 5% of first-year birds allowed under the general falconry policy.

S21

Barred Owl removal halts long-term population declines of Spotted Owls in old forests of the Pacific Northwest

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The conservation and management of Northern Spotted Owls (*Strix occidentalis caurina*) is one of the most visible, long-standing wildlife conservation issues in United States history. Despite over 30 years of federal protection, populations of Spotted Owls have continued to decline at an accelerating rate throughout the subspecies' geographic range. Competition with rapidly increasing populations of invading Barred Owls (*Strix varia*) has been identified as a primary and immediate cause of Spotted Owl population declines. We replicated a before-after-control-impact removal experiment in five long-term (2002-2019) Spotted Owl demographic study areas to determine if Barred Owl removal can improve declining population trends of Spotted Owls. Lethal removal of Barred Owls had a strong, positive effect on survival of Spotted Owls across all study areas, and a weaker but positive effect on Spotted Owl recruitment. After Barred Owl removal, the mean annual rate of population change for Spotted Owls stabilized in areas with removals (<0.2% decline per year), but continued to decline sharply in areas without removals (12.1% decline per year). Our results show that the preservation of Spotted Owls, and perhaps many other impacted old-forest species, will depend heavily on management strategies that reduce the negative impact of invasive Barred Owls while simultaneously addressing other key threats, including habitat loss.

S22

Human dimensions of raptor conservation and persecution: Golden Eagles of the American West

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Contemporary issues of raptor conservation and management encompass both scarcity and abundance. Both threatened and common species face challenges whose root causes are anthropogenic. Today, the scope and complexity of raptor

conservation and management requires tools beyond those of biology and ecology. But a human dimensions orientation remains an uncommon tool in raptor conservation and management toolbox, particularly in the USA. To demonstrate the necessity and efficacy of a human dimensions orientation, we present a case study of Golden Eagle (*Aquila chrysaetos*) conservation in the American West. Evidence suggests anthropogenic mortality accounts for 74% of Golden Eagles deaths after their first year, with shooting the leading cause therein. In partnership with the U.S. Fish and Wildlife Service, a multi-state study was conducted to identify management alternatives that incorporate human dimensions. We evaluated raptor persecution experiences among landowners, rehabilitators, biologists, and law enforcement officers, given the difficulty of obtaining data from perpetrators directly. Findings indicate coexistence with Golden Eagles remains tenuous among certain populations and specific geographies. Participants identified misinformation, ignorance, and embedded cultural beliefs as the main motivations for raptor shooting. Overall, findings demonstrate the utility of a human dimensions orientation to manage contemporary issues. As most threats to raptor populations are directly or indirectly attributable to humans, the human dimensions are an essential tool in the raptor conservation and management toolbox.

S23

Raptor management on tribal lands of the Western United States

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Birds of prey have inspired mankind throughout recorded history. Among Indigenous peoples of Western North America, diurnal raptors, particularly eagles, have significant religious importance. Native communities have been on the forefront of efforts in rehabilitation of injured raptors, monitoring eagles and other raptor populations on their Nations, and some tribes have built eagle aviaries with diverse goals aiding in eagle conservation. Examples of these efforts include long-term population studies of Golden Eagles (*Aquila chrysaetos*) in the Southwest USA on the Hopi Tribal Reservation (27 consecutive years), Jicarilla Nation (22 consecutive years) and Navajo Nation (27 intermittent years). Furthermore, Southwestern tribes actively participated in U.S. Fish and Wildlife Service research efforts in the 2010s. Non-eagle conservation efforts include monitoring Peregrine Falcon (*Falco peregrinus*) populations on the Jicarilla Nation since 1980. Finally, eagle aviaries allow tribes to achieve their goals of eagle conservation through activities such as rehabilitation, care of non-releasable eagles, outreach education, and research, with each aviary having a unique mission. Currently, there are eight aviaries with six in the Southwest and two in the Pacific Northwest of the USA. To begin compiling these efforts and to gain a better understanding of eagle and raptor conservation on tribal lands, we prepared two questionnaires to query tribal agencies about their activities in raptor management in 2023. One addressed eagle aviary endeavors while the other asked questions about free-flying eagle and raptor population management on native lands. Responses received by July 2023 will be summarized and presented at the symposium.

S24

Effects of the Woolsey Fire on nesting territories of Southern California Red-tailed Hawks

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The relationship between fire and viable habitat is complex. Fires can create more resources for some species and simultaneously extirpate entire populations of other species. In late 2018, the Woolsey Fire scorched much of Ventura County, California, changing the flora and fauna composition. Red-tailed Hawks (*Buteo jamaicensis*) choose viable habitat and nesting sites according to surrounding resources. Natural disturbances such as wildfires change the availability of those resources. Nest site use was tracked in the Santa Monica Mountains of Ventura county from the 1970s to 2019. The study area is surrounded by both mountain ranges as well as suburban areas. Each survey started at a trailhead near historical nesting spots. Red-tailed Hawks' location and nests found in the area were recorded with GPS measurements containing latitude and longitude coordinates. We hypothesized that the magnitude of the burn within the third order habitat selection is correlated to the raptors' nesting patterns. In addition, we proposed that geographic position relative to the fire border, and not just local destruction of nests, is a key variable in nest survival. This hypothesis is corroborated in that more Red-tail Hawk nests remained active in Woolsey Fire edge zones. Furthermore, one factor that had no correlation on nest survival rates was tree species.

S25

Habitat selection, demography, and evolutionary ecology of Spotted Owls in fire-prone forests of the Southwestern United States: implications for conservation

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In seasonally dry forests of the Western United States, fire suppression and climate change have caused a considerable increase in fire severity in forests that historically experienced low-severity fire. What are the implications of changing fire regimes for an icon of biodiversity conservation, the Spotted Owl (*Strix occidentalis*)? Over the past decade, we have engaged in series of sequential studies that have investigated this question at multiple levels. Following large, high-severity 'megafires', Spotted Owl populations experience precipitous

populations declines, which are persistent through time. Individual owls that continue to occupy burned landscapes typically possess territories characterized by lower burn severities. Such individuals do show strong preference for high-severity burn patches - but only when patches are ~10 ha in size or smaller; consistent with maximum high-severity patch sizes present in the owl's evolutionary environment. These smaller patches of high-severity fire introduce heterogeneity into otherwise homogenous fire-suppressed forests. Trophic ecology studies have shown that in heterogeneous landscapes, owls consume more woodrats, which in turn lead to higher estimated territory persistence and stable population trajectories. In sum, the body of work produced by our group in the past decade can be summarized with the following statement: landscape diversity is the key to conserving Spotted Owls over the long-term. Landscape diversity, whether produced by 'good fire' (i.e. that promotes 'pyrodiversity') or by mechanical ecological restoration activities, creates the multi-scale variability that supports Spotted Owl foraging ecology, nesting habitat, and evolutionary potential.

S26

Fire legacies and megafires determine Flammulated Owl occupancy in the Sierra Nevada

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Mixed conifer forests in Western North America historically experienced relatively frequent fires that burned at varying severities. However, European colonization, forest management practices, and climate change have contributed to a new era of megafires that burn large areas of forest and consume dominant live trees. Flammulated Owls (*Psiloscops flammeolus*) are adapted to fire-dependent ecosystems, but we have yet to understand how this species will respond to changing fire regimes. We examined the occurrence patterns of Flammulated Owls in the Sierra Nevada, where fires have increased in severity, size, and frequency over the past four decades. We modeled occupancy using automated acoustic detections from passive surveys performed during the 2021 and 2022 summer breeding seasons. We examined associations with habitat burned in the past 35 years and quantified the effect of novel megafire disturbance on the distribution of this understudied species. We detected Flammulated Owls in 162 sites (10% of all surveyed sites) in 2021 and 110 sites (7% of all surveyed sites) in 2022. Flammulated Owls were more likely to occupy sites that experienced 5-10 years of regeneration following lower severity fire and less likely to occupy sites that experienced no regeneration following higher severity fire. Sites that were occupied in 2021 were more likely to become unoccupied in 2022 following high severity fire. Megafires pose a threat to forest species that rely on low/mixed-severity fires, but understanding the complex spatial and temporal responses to disturbance will inform management decisions to promote conservation and mitigate fires.

S27

Wildfire response of GPS-tracked Bonelli's Eagles in Eastern Spain

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Little is known about the interaction between predators and wildfires, in part because the large home range and scarcity of predators make their study difficult, and their response is strongly species-specific. In this paper, we first study the effect of wildfire on the behavior of Bonelli's Eagles (*Aquila fasciata*) simultaneously tracked by GPS/GSM dataloggers in four neighboring territories. One territory was burnt in a wildfire and the other three were used for comparison. We computed the home-range area by comparing individual spatial and temporal behavior before, during, and after the fire event using kernel density estimators and movement parameters. Our results show an immediate negative effect during the first days of the wildfire for an individual inhabiting the burnt territory – the individual flew directly away from the burning area. However, after a few days, the individual recovered their usual behavior. The three neighboring pairs did not show significant differences in behavioral parameters before, during, and after the wildfire. Our results suggest that occasional wildfires do not affect the distribution and density of Bonelli's Eagles in the short or medium-term (two years after the wildfire). This could be the result of adaptation by this species to the frequent and recurrent wildfires in the Mediterranean area.

S28

Garrkan – an Australian raptor using fire to effect landscape-scale management in savannah woodlands

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In 2017 colleagues and I documented preliminary research and findings on intentional fire-spreading behavior by several Australian raptors. That publication, though primarily based

on direct observations by non-Aboriginal land managers, briefly noted the centrality of Aboriginal knowledge of this behavior to our research and identified that knowledge base as a future research priority. Following up on that work, since 2017 I have concentrated on two primary research tasks. Firstly, reviewing interviews conducted between 2009 and 2017 with senior Aboriginal traditional landowners, cultural knowledge holders and land managers. Secondly, the conduct of further interviews with Aboriginal landowners, knowledge holders and land managers between 2018 and 2023. In this presentation I will examine the important roles that Garrkan, the Brown Falcon (*Falco berigora),* is accorded as a landscape-scale land manager through the manipulation of wildfire, as a cultural actor in traditional ceremonies and cultural practices and beliefs, and as a "troublemaker for fire". I will provide examples of the reverence, respect, and occasionally fear with which Garrkan is regarded and how Garrkan is but one of a number of sentient actors in an landscape enlivened by culture, ceremony and tens of thousands of years of accumulated knowledge and lived experience. Finally, I will summarize the research undertaken to date and prospects for future collaborative research with local Aboriginal land management organizations and opportunities for publication.

S29

Synergies and trade-offs: identifying mutually beneficial goals for fuel reduction treatments and conservation of Spotted Owls in the Sierra Nevada

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Proactive management through fuel reduction is the dominant mitigation strategy for preventing uncharacteristically large and severe wildfires throughout the Sierra Nevada, however there are concerns over the potential impacts of treatments on California Spotted Owls (*Strix occidentalis occidentalis*). Our goal was to identify synergies and trade-offs between forest fuel reduction treatments and owl habitat use. We used mixed-effects habitat selection functions to examine both individual- and population-level habitat selection for California Spotted Owls in relation to fuel characteristics including canopy base height, canopy bulk density, canopy layer count, ladder fuel density, and surface fuels. We then classified the Sierra Nevada into four management categories (low priority, fuel treatment, potential conflict, and conservation) based on probability of California Spotted Owl habitat use and fire risk. Owls selected for higher canopy base height, lower ladder fuel densities, and lower canopy bulk densities, all of which are consistent with goals to decrease fire risk through fuel reduction treatments. Owls also selected for higher levels of surface fuels and greater canopy layer count, which we identified as potential trade-offs between fuel treatments and owl management objectives. Most of the Sierra Nevada landscape could be classified as a low priority management area, followed by fuel treatment zones, potential conflict areas, and conservation areas. This pattern held across all ownership types, suggesting that most of the Sierra Nevada bioregion could be managed with fuel reduction treatments without negatively impacting California Spotted Owls, and, furthermore, that fuel treatments may be beneficial for owl foraging habitat selection.

S30

Multi-scale habitat selection by Northern Goshawks in a fire-prone forest

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Increasing frequency and severity of wildfire may jeopardize persistence of large tracts of late seral forest, raising concerns over population viability of forest-dependent species like the Northern Goshawk (*Accipiter gentilis*). We tracked 20 adult Northern Goshawks with GPS loggers over four years to investigate roosting (nocturnal) and foraging (diurnal) habitat selection in a heterogeneously burned forest landscape of the Sierra Nevada Mountains of California, USA. Goshawks selected late seral forest attributes for both roosting and foraging at multiple spatio-temporal scales, although at the finest (daily) scale, goshawks selected more diverse forest structure that included small trees and medium canopy cover. Less than 6% of roosts were in areas burned in the last 50 years and goshawks avoided areas burned at high severity when roosting and when foraging across spatial scales. Four goshawks (three males, one female) undertook forays >5 km from their nest location, two of which forayed into burned areas during at least one season. High severity fire is likely to make forests unsuitable foraging or roosting habitat for Northern Goshawks, although lower severity fire may provide foraging opportunities for this generalist predator. Eighty percent of foraging space use and 87% of roost locations were considered high fire hazard potential, suggesting that goshawk habitat in western North America is likely to be reduced by predicted increases in fire frequency and severity in the region.

S31

Using prescribed fire in Mexican Spotted Owl occupied habitat: results of a collaborative management experiment

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Currently, one of the greatest threats to the federally threatened Mexican Spotted Owl (*Strix occidentalis lucida*) is the loss of forested nest/roost habitat following large, high-severity, stand-replacing fires. An effective means of reducing this risk may be the use of prescribed fire, either alone or in conjunction with tree thinning. Monitoring of forest treatment effects to owls is essential to documenting fire effects to Mexican Spotted Owls. The U.S. Fish and Wildlife Service and the U.S. Forest Service conducted a management experiment as a part of the Four Forest Restoration Initiative, a landscape scale fuels reduction and forest restoration project, to study the effects of prescribed fire on Mexican Spotted Owl occupancy, reproductive success, and key habitat components. The agencies conducted owl and vegetation monitoring in treatment and reference protected activity centers (PACs). Partners conducted the burning in treatment sites in October 2017 and results indicate that owls and habitat persisted five years post-treatment. However, there are many challenges to conducting the rigorous monitoring needed to ensure forest and fire management supports recovery objectives for the Mexican Spotted Owl.

S32

Effects of clade 2.3.4.4 highly pathogenic H5N1 influenza A virus on Bald Eagles and Black Vultures in the Southeastern USA

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The late 2021 introduction and ensuing outbreak of highly pathogenic A/goose/Guangdong/1/1996 2.3.4.4b lineage H5N1 influenza A virus (HPIAV) in North America has led to the deaths of thousands of wild birds. Since that time, alarming mortality patterns including nesting failures emerged in Bald Eagles (*Haliaeetus leucocephalus*) and Black Vultures (*Coragyps atratus*) in the Southeastern USA, largely attributable to predation and scavenging on infected dying and dead birds. Our objectives were to investigate these patterns through diagnostic and field data. HPIAV was detected via real-time reverse transcription polymerase chain reaction of swabs or tissues from 101/125 (81%) Black Vultures and 50/135 (37%) Bald Eagles evaluated at the Southeastern Cooperative Wildlife Disease Study since January 2022. Many had neurologic signs and severe multiorgan damage, consistent with acutely fatal disease. Additionally, annual Bald Eagle nest monitoring in Florida and Georgia revealed marked decreases in nest success and productivity in some coastal counties in 2022. For example, county-specific nest productivity declined by up to 62% in 2022 versus annual means for the previous six-seven years, and affected areas corresponded to HPIAV-associated waterfowl die-offs. Concurrently, widespread, mass die-offs at Black Vulture roosts were attributed to long-term, perpetual transmission fueled by scavenging of conspecifics that died of HPIAV. High susceptibility evident early in the outbreak and high visibility suggest utility of Bald Eagles and Black Vultures as HPIAV indicator species. HPIAV has persisted since late 2021 and continued to evolved in North America and may pose a population risk to some avian species, warranting continued vigilance.

S33

Utilization of wildlife rehabilitation for surveillance — 2022 outbreak of highly pathogenic avian influenza virus

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Wildlife rehabilitation facilities provide opportunities to collect vital data on disease ecology/epidemiology and clinical illness in birds admitted straight from the wild. During 2022, Minnesota avian populations were substantially impacted by highly pathogenic avian influenza virus (HPAI). The Raptor Center (TRC) at the University of Minnesota admits over 1,000 wild raptors annually for rehabilitation. TRC enacted intensive biosecurity and testing procedures in order to safely continue admitting sick birds during the HPAI outbreak, while simultaneously collecting extensive data on HPAI in raptors. From March - December 2022, TRC tested 997 raptors for active HPAI infection utilizing influenza A matrix RT-PCR testing from oropharyngeal/cloacal swabs. Positive samples were referred to the National Veterinary Services Laboratories for further viral characterization. Of 997 birds, 213 (21.4%) individuals, representing 12 species, were confirmed positive with HPAI. Great Horned Owls (*Bubo virginianus*, N=92) and Bald Eagles (*Haliaeetus leucocephalus*, N=48) comprised over half of the positives. In addition to PCR testing, beginning in the fall of 2022, blood was collected close to admission for serology testing. Serum or plasma samples were analyzed for avian influenza (AI) antibodies using a blocking ELISA (IDEXX AI MultiS-Screen Ab Test). Preliminary serology results detected antibodies in over 50% of Bald Eagles tested, and in three additional raptor species. Samples are being further characterized via outbreak specific viral typing.

Wildlife rehabilitation presents a unique opportunity to better understand impacts of outbreaks on wildlife populations by augmenting free-ranging outbreak data with enhanced surveillance and sampling.

S34

Clinical presentation and pathology findings in raptors infected with Highly Pathogenic Avian Influenza Virus (H5N1 clade 2.3.4.4b)

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Since March 2022, The Raptor Center (TRC) at the University of Minnesota has conducted active viral surveillance for highly pathogenic avian influenza (HPAI) virus on all birds presenting to TRC. This testing data has been paired with intensive clinical evaluation. In 2022, TRC admitted 213 confirmed HPAI positive individuals representing 12 different raptor species. Each individual had documentation of clinical signs allowing for an in depth analysis of different disease manifestations of this HPAI viral strain. Of the positive testing birds that presented alive for evaluation, 83% had some clinical sign on examination or epidemiologic link suggestive of HPAI, 16% had no suggestive indicators, and 1.5% died before full evaluation. The most common clinical signs included: abnormal mentation, abnormal posture, ataxia, seizures, muscle tremors, nystagmus, and rapid decline and/or death. Of the 213 positive birds detected, only one Great Horned Owl (*Bubo virginianus*) survived and was released back to the wild. Twenty-three positive birds who did not survive underwent rapid necropsy evaluation. All necropsied birds had histologic lesions in the brain attributed to HPAI infection and viral antigen was detected in the brains of 21 individuals. The pairing of clinical and pathological data with diagnostic testing during disease outbreaks generates important insight into the presentations and progression of HPAI virus in raptor species entering rehabilitation. Wildlife rehabilitation represents an important pathway to obtaining intensive data and clinical evaluation that can add important information to the big picture of disease impact on wild bird populations.

S35

Techniques and practical application of feather imping to shorten captive care times in wildlife rehabilitation

Emily M Davenport

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Feather imping is a technique used to repair damaged feathers using a donor feather. Imping has been around for centuries and was first mentioned during the Roman Empire. It has been described by kings, mentioned by Shakespeare, and is regularly used by Falconers. More recently, imping has been used in Wildlife Medicine to shorten the length of time in captive care. Free-ranging raptors often present to rehabilitation centers with damaged feathers caused by trauma or disease. In many cases in which feather damage is diagnosed, imping the damaged feathers is an easy technique to restore flight capability, thereby decreasing the time needed for rehabilitation. Methods of feather repair evolved from Middle Eastern falconry practices and modern advancements have provided refinements to this ancient practice. Through case studies from the Rocky Mountain Wildlife Alliance, we reviewed techniques, implementation, and success of imped feathers for release candidates. When performed by a trained and skilled hand the results are often very successful. Imping is a very useful, simple, and efficient technique to treat damaged feathers in raptors. Imping can be used to repair damaged feathers of raptors to shorten the time in captive care prior to release. Rehabilitated birds with damaged feathers can be released earlier, because they do not have to be maintained in captivity for a complete molting period.

S36

Indolent corneal ulcer in a Great Horned Owl: diagnostic evaluation, treatment strategies, and complications

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Indolent corneal ulcers are uncommon but significant ocular conditions in avian species, particularly in raptors. This research presents a case report of an indolent corneal ulcer in an after hatch year Great Horned Owl (*Bubo virginianus*). Diagnostic evaluation involved a thorough ophthalmic examination, including corneal cytologic and histopathologic examination. The clinical management comprised a combination of medical and surgical interventions to achieve corneal healing and control uveitis. The medical regimen included oral administration of meloxicam and gabapentin, along with topical application of ofloxacin and oculenis. Surgical interventions involved debridement with a diamond bur and tarsorrhaphy. These measures initially proved effective in achieving complete corneal healing and managing observed uveitis. The owl underwent monthly follow-up examinations to monitor its progress and explore further treatment options. This case provides insights into various treatment strategies, emphasizing the importance of regular monitoring and adjusting the treatment plan based on the individual response. The case highlights the significance of case reports in documenting successful outcomes and contributing to avian ophthalmology literature. Complications arising from nerve damage to the nictitating membrane led to the decision to perform evisceration. This case report underscores the challenges associated with avian ocular conditions and the potential need for surgical interventions as a last resort. Further research is warranted to explore alternative treatments and preventive measures to mitigate complications associated with indolent corneal ulcers in avian species.

S37

Anticoagulant rodenticide exposure in owls and diurnal raptors from New Mexico

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Anticoagulant rodenticides (ARs) are commonly used in the United States for the elimination of commensal rodents. The risks of ARs to non-target wildlife are widely known and have been documented world-wide. New Mexico is sparsely populated with a high diversity of raptors. Although AR exposure and toxicity have been documented in Arizona and Colorado raptors, no information is available in NM. Hawks Aloft is a nonprofit organization that runs a state-wide program to rehabilitate and release injured wild raptors. From November 2020 to January 2023, 60 birds that presented to Hawks Aloft were tested for exposure to eight ARs (warfarin, brodifacoum, bromadiolone, chlorphacinone, dicoumarol, difenacoum, difethialone, diphacinone) at the Michigan State University Diagnostic Lab. Nine species were represented: buteos (Red-tailed Hawk (RTHA), *Buteo jamaicensis*; Ferruginous Hawk, *B. regalis*; Swainson's Hawk, *B. swainsoni*); owls (Great-horned Owls (GHOW), *Bubo virginianus*; Barn Owl, *Tyto alba*; Long-eared Owl, *Asio otus*); accipiters (Cooper's Hawk, *Accipiter cooperii*); eagles (Golden Eagle (GOEA), *Aquila chrysaetos canadensis*); and a single falcon (Peregrine Falcon, *Falco peregrinus*). Blood samples were obtained from 56 birds; liver samples were obtained from nine birds that were euthanized. Both liver and blood samples were obtained from five birds. Two blood samples (RTHA, GOEA) were positive for brodifacoum. Five liver samples (three RTHA, a GOEA, a GHOW) were positive; one for brodifacoum, two for bromadiolone, and two for both. None of the birds with positive liver results had positive blood results. Sampling blood for AR exposure may result in false negatives.

S38

Detection of *Chlamydia buteonis* in Red-tailed Hawks in 13 counties in California during winter 2022

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Chlamydia buteonis is a bacterial organism infecting birds of prey that exhibits similar clinical and pathological signs as parrots with *Chlamydia psittaci.* Treatment has not been established for this organism and its zoonotic potential is still unknown. Between November 2021 and May 2022, 100 Red-tailed Hawks (*Buteo jamaicensis*) were submitted from 23 counties in California (CA) to the CA Department of Fish and Wildlife for postmortem examination by wildlife rehabilitation centers, members of the public and agencies. Clinical signs were generally non-specific and included malaise, dehydration, and poor body condition. The primary findings during postmortem examination were emaciation (76%; 76/100), an enlarged spleen (38%; 38/100) and thickened air sacs (22/100). Histopathology was performed on samples from 46 hawks and immunohistochemical (IHC) staining for Chlamydial organisms was performed on samples from 42 haw ks. Chlamydial organisms in the liver and spleen were identified by IHC in 35/42 (83%) birds. Tissue PCR was performed on liver (N=35) and spleen (N=28) of both IHC positive and negative samples. Positive tissue PCR correlated with IHC in 15/35 (43%) liver and in 13/28 (46%) spleen samples and negative tissue PCR correlated with IHC in 11/35 (31%) liver and 9/28 spleen samples. Overall, IHC and tissue PCR correlated in 48/63 (75%) of all liver and spleen samples, suggesting IHC can be used to identify both positive and negative cases of *C. buteonis* in Red-tailed Hawks.

S39

Trace element exposure in Golden Eagle nestlings across western Utah

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Golden Eagles (*Aquila chrysaetos*) are a Species of Greatest Conservation Need in Utah and are federally protected under the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act. Despite regulatory action, the species' long life-history traits, such as slow sexual maturation and low fecundity, in combination with a growing list of potential threats, make the golden eagle population in the western United States susceptible to ecological perturbations. For example, lead is a well-documented trace element that has been anthropogenically introduced and can be a negative population driver in Golden Eagles. While tracking trace elements or heavy metals, such as lead, can be difficult in adults, given that ingestion is the primary route of exposure to trace elements, precocial nestlings provide easy capture, sampling, and the opportunity to track landscape-level stressors that potentially affect all individuals in the region. Between 2020 and 2022, a total of 56 motion-activated cameras were deployed at In-Use nests across western Utah. Approximately 771,000 photos captured nestling behavior, adult attendance, and diet composition. 3,169 dietary items were catalogued over the three years and 70 nestlings had blood drawn to quantify exposure to 29 trace elements, two pathogens (AIV, WNV), and two species of haemoparasites. Nest cameras were deployed during two pathogenic events that potentially impacted their sources of prey (Rabbit Hemorrhagic Disease Virus Two (RHDV2) and Highly Pathogenic Avian Influenza (HPAI). In the presentation, we'll present results from sampling 77 nestlings during their development, across western Utah between 2020 and 2022.

ABSTRACTS

ANDERSEN AWARD PRESENTATIONS

AA01

Cooperative breeding in South Texas Harris's Hawks revisited: male-biased delayed dispersal, mixed parentage broods, and the relatedness of adult helpers

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Identifying how social groups form, interact, and vary is fundamental to understanding the evolution of cooperative breeding. Although most avian breeding auxiliaries are retained offspring from previous broods, the Harris's Hawk (*Parabuteo unicinctus*) is somewhat unique in which extra birds in groups are both kin and non-kin individuals. Here, we report on the group dynamics, formation, structure, and stability of cooperatively breeding Harris's Hawk groups in South Texas. We censused 65 nesting territories in the Lower Rio Grande Valley of south Texas, banded nestlings, took blood samples for genetic analysis, and documented the occurrence of fledglings for at least a year post-fledging. We found that 58.4% of nestlings (N=65) delayed dispersal for at least 6 months and 7.7% (N=5) remained with their natal group for at least 12 months after fledging. To investigate which biological, temporal, and spatial variables influence delayed dispersal, we used generalized linear mixed models that showed delayed dispersal is male-biased and positively related to conspecific density. Using microsatellite analysis, we confirmed mixed-parentage in Harris's Hawks for the first time and documented that at least some adult auxiliaries were unrelated to the breeding female. Our data suggest that natal philopatry may be favored when young males have limited access to breeding opportunities or territories, but is not the primary source of adult helpers at south Texas nests.

AA02

Snow modulates movements and fitness of a facultative migrant, the Great Gray Owl

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Movement is a key mechanism by which animals respond adaptively to environmental change. However, knowledge gaps persist related to behavioral responses to climatic stressors, and their fitness effects. In particular, how snow affects wildlife remains poorly understood, despite the key role that snow plays in ecological processes. We evaluated whether winter snow conditions influence fine-scale habitat selection, broad dispersal movements, and/or subsequent reproduction by a facultative migrant, the Great Gray Owl (*Strix nebulosa*). We hypothesized that conditions that restrict owls' access to subnivean prey prompt movement responses and negatively affect breeding. We used SnowModel, a data-fusion snow modeling system, to estimate fine-scale, spatiotemporally explicit snow crust conditions and snow depths within the Greater Yellowstone Ecosystem (GYE) between 2017-2022. We evaluated habitat selection, dispersal behavior, and reproductive output in response to snow using Step-Selection Functions, Cox proportional hazards analysis, and Generalized Linear Mixed Models, respectively. Owls proximately avoided deeper snow and more severe wind crusts. Probability of dispersal increased with more severe and persistent ice crusts (caused by rain-on-snow and melt-freeze events). In the GYE, wind crusts are locally spatially heterogeneous, whereas ice crusts can affect broader areas. Owls therefore appear to be behaviorally plastic, adopting different strategies depending on the spatial scale and duration of limiting conditions. Winter snow crust conditions carried over to influence subsequent breeding, although direction of fitness responses differed for wind versus ice crusts. Our findings have implications for understanding vulnerability to climate change, which is occurring at unprecedented| rates and scales.

AA03

Impacts of habitat type on individual Prairie Falcon movement and foraging behavior during the breeding season

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Movement ecology has emerged as a conceptual framework to explore complex relationships between animal behavior and ecology and has vast untapped potential to guide conservation practices. Understanding the underlying mechanisms driving movement and individual variation in aerial predators is essential, considering the critical role of higher trophic levels in ecosystem functioning. We shed new light on the movement patterns and individual variation of 17 breeding Prairie Falcons (*Falco mexicanus*) within the Morley Nelson Snake River Birds of Prey National Conservation Area in southwest Idaho during 2021 and 2022. We aimed to assess (1) functional habitat use, (2) individual differences, and (3) temporal shifts in movement patterns. Using hidden Markov models, we categorized movement into two states: 'canted' (relatively slow, tortuous movement) and 'strafing' (relatively fast, directional movement), and linked movement parameters to four distinct habitat types. Preliminary findings indicate wide variability in functional habitat use among Prairie Falcons, both in native and non-native habitats, hinting at potential resilience to ongoing habitat change. Results suggest some individuals exhibited more tortuous movements as native perennials or invasive annuals increased. Additionally, encountering native sagebrush cover increased the probability of transitioning from canted to strafing movement for multiple individuals. During the brood-rearing period, Prairie Falcons increased the proportion of time spent in a strafing state, suggesting increased travel distances or foraging trips when food demand is highest. Understanding functional habitat use can inform effective conservation strategies, while individual differences provide insights into the adaptive capacity of Prairie Falcon populations in a rapidly changing world.

AA04

Modeling goshawk nesting habitat selection in southern Colorado

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The Northern Goshawk (*Accipiter gentilis*) is designated as a sensitive species in five of nine Forest Service regions in the United States. Research has identified mixed results whether or not forest management as well as habitat changes from a variety of sources is affecting species abundance along with a better understanding of what environmental variables goshawks are selecting for nesting habitat. This project will identify what habitat variables are the most important for nest areas chosen by goshawks in southern Colorado and then use those variables to model acceptable nest areas. Our study is in the southern edge of their known range in south-central Colorado. Using game call devices, acoustic recorders, and field searches, we were able to locate active and non-active goshawk nests. GPS coordinates at each nest allows us to extract vegetative, physiographic, anthropogenic, and landscape spatial variables in comparison with 100 random nests within the study area. Using an absence vs presence study design, we constructed generalized linear models. Our top model contained both of these variables as well as nest proximity to aspen stands. Using our top models we created habitat suitability maps to inform land managers in the region where the most suitable nesting habitat is located.

AA05

Assessing occupancy of an elusive forest raptor using passive acoustical monitoring

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Traditional monitoring methods often fall short when surveying elusive and wide-ranging species such as Broad-winged Hawks (*Buteo platypterus*). To study occupancy patterns of this species, we deployed autonomous recording units (ARUs) at more than 1,000 unique forested locations in Pennsylvania, developed a machine learning classifier, and performed classifier-guided listening to analyze approximately 106,000 hours of recording unit data. We used the detection data to build a Bayesian single-species spatial occupancy model that accounted for imperfect detection and spatial autocorrelation, while also incorporating landscape and vegetation covariates. Additionally, we developed an acoustic classifier to document the presence of Broad-winged Hawk chicks in recordings from ARUs placed near nests. Our findings suggest a positive correlation between occupancy probability and linear density of roads and the proportion of developed areas in the local landscape. This result could suggest an adaptive response by Broad-winged Hawks to anthropogenic landscapes, possibly due to the increased

availability of fragmented and foraging areas. Conversely, occupancy probability had a negative relationship with open water and slope. At the site level, occupancy was positively associated with understory vegetation density and peaked at moderate values of variance in tree height, indicating a possible association for diverse, mixed-age forests. Our approach shows the effectiveness of passive acoustic monitoring and machine-learned classifiers to study raptor distributions and trends. Moreover, our results will be helpful for designing future studies intended to inform Broad-winged Hawk conservation.

AA06

Independence Day: comparison of methods to estimate the onset of dispersal in raptors

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In raptors, the onset of dispersal (or the achievement of independence from parents) is a key moment for survival which ultimately affects individual's fitness. Since individual variation in life-history strategies and context-dependent situations can make movement patterns difficult to decompose, the determination of the onset of dispersal in raptors has traditionally been a matter of discussion. Although the development of tracking technologies to follow individuals has allowed researchers to better estimate this moment, there are still inconsistencies on how to mathematically address this issue with rigorous and repeatable methods. Also, most methods require a previous knowledge on the home range areas of adults, which in little-known species is not always possible. We used unique GPS data from parent Chaco Eagles (*Buteogallus coronatus*) with their corresponding fledglings during the post-fledgling dependence period (the stage prior to dispersal) as a reference against which to evaluate the different methodologies available. We also evaluated new methods related to the changes in home range relative sizes and overlap values of young individuals. For each method, we calculated the mean deviation and bias on an individual-by-individual basis. Most of the previously published methods assigned the onset of dispersal prematurely, probably because they are sensitive to long exploratory, pre-migratory and/or foraging movements. However, the methods that we proposed provided similar estimates on the onset of dispersal. These methods are relatively simple to compute, do not require previous information on the biology of the species and can be standardized to any other raptor species.

AA07

Biological factors associated with the autumn departure timing of North American migratory raptors across a broad-scale

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The biological and ecological factors influencing the timing of autumn departure of migratory raptor species from their breeding areas are not well understood. Studying the timing of departure is challenging because the majority of data collected to assess migration timing takes place at migration count sites once raptors are already en- route. In this study, we examined the relative importance of life history traits in shaping departure timing of migratory raptors using data from a global community science project, eBird. We estimated the timing of departure for 15 raptor species from portions of their North American breeding areas where each species is a complete migrant from 2011 to 2021. We found that raptors departed from their breeding areas starting in mid-July, and departures peaked in mid-September. As expected, birds at more northern latitudes departed before birds at more southern latitudes (β=-16.95, 90% CI=1.41). Species that migrate socially departed earlier than those that migrate alone (β=-29.77, 90% CI=9.72). Larger bodied species tended to depart later than smaller species (β=10.40, 90% CI=7.66). Additionally, social and long-distance migrants had less annual variation in departure timing. We found that eBird is a useful tool for assessing spatial variation of migration departure timing across the continent. Results from this study further our understanding of the relationships between life history traits and departure and provide new insight into factors associated with annual variation in migration timing, which may underlie vulnerability to changing environmental conditions.

AA08

Status and conservation challenges of vultures in Pokhara, Nepal: globally threatened species

Hemanta Dhakal

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Pokhara, Nepal supports six resident vulture species including the White-rumped Vulture (*Gyps bengalensis*), Slender-billed Vulture (*Gyps tenuirostris*), Egyptian Vulture (*Neophron percnopterus*), Red-headed Vulture (*Sarcogyps calvus*), Himalayan Vulture (*Gyps himalayensis*) and Lammergeier (*Gypaetus barbatus*). Three other vultures species are also observed in Pokhara including a winter visitor: the Cinereous Vulture (*Aegypius monachus*), a passage migrant: the Eurasian Griffon

Vulture (*Gyps fulvus*), and a vagrant: the Long-billed Vulture (*Gyps indicus*). We used direct observations at 12 different vantage points repeatedly every year (2016-2023) between 8:00-11:00 am on International Vulture Awareness Day to determine the status of these globally threatened species. We categorized each vulture age as either mature (fully grown adult) or immature (juvenile and sub-adult), and recorded behaviors (e.g. soaring, roosting, or feeding on carcasses). We documented an increase in the number of vultures between 2016-2019, and recorded the highest number of mature individuals in 2017 and immatures in 2019. In addition, we recorded a greater abundance of Egyptian Vultures and a lower abundance of Bearded Vultures. We confirmed one active Slender-billed Vulture nest and nine active Egyptian Vulture nests. During the six year study we found 16 dead vultures of five different species with major threats in the region including electrocution, collision, poisoning, and habitat loss.

AA09

Factors influencing occupancy, success, and nestling growth at American Kestrel nest boxes in the Upper Midwest

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The American Kestrel (*Falco sparverius*) is a widespread raptor experiencing critical population declines in the United States. Trends from migration sites and annual bird counts track kestrel declines as beginning as early as the 1960s, but decades of research have failed to identify the primary causes of kestrel population decline throughout their range. Kestrels are likely experiencing different threats at regional and even local scales, and many programs have been established to construct and monitor kestrel nest boxes for research and/or conservation. Despite such programs existing, kestrel productivity in the Upper Midwest has not been as extensively studied as in other regions of the country. The primary objective of this project is to analyze data on occupancy, success, and nestling growth at kestrel nest boxes in Minnesota and Wisconsin that may be used to inform future management and conservation practices locally for this declining species. A total of 448 kestrel nest boxes were monitored in 2022 and 2023. We banded and recorded morphological data from kestrel nestlings at all occupied boxes. Habitat effects on nest box use and success were analyzed through GIS at various buffer scales around each nest box. We analyzed δ15N and δ13C in nestling feathers to assess potential dietary impacts on nestling growth. Preliminary results suggest that nest box occupancy and success differ among boxes and sites with differing habitat characteristics, though nestling growth is not impacted by diet quality; rather, diet quantity and primary productivity of habitat may influence nestling growth at our sites.

AA10

Disentangling trophic dynamics of sympatric raptors in the Tagus Estuary during the non-breeding period

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Raptors play a key role in the stabilization of prey populations, many of which are considered harmful to humans. Despite the importance of these predators, only a few studies have simultaneously compared how different species exploit the resources of the same community. From January to March 2022 and April 2023, we collected and compared the trophic niche overlap of sympatric and contemporary raptors in the Tagus Estuary. The analysis focuses on species such as Short-eared Owls (*Asio flammeus*), Barn Owls (*Tyto alba*), Long-eared Owls (*Asio otus*), Black-winged Kites (*Elanus caeruleus*), Common Kestrels (*Falco tinnnunculus*) and Little Owls (*Athene noctua*). The only prey shared by all these predators were mice (*Mus sp.*), with every raptor species showing some variation in the remainder of its diet. Insects have higher importance in the diet of Common Kestrels and Little Owls. While Barn Owls and Black-winged Kites consumed relatively more shrews (*Crocidura sp.* and *Suncus sp.*) and voles (*Microtus spp.*) than Short-eared Owls, the latter's diet had more birds. Although the diet of Short-eared Owls and Barn Owls have been compared a few times, the larger sample size and the addition of other raptors in our study provide new insights into the trophic dynamics of the raptor guild. Consequently, these results highlight the importance of raptor diversity in maintaining ecosystem balance.

ABSTRACTS

GENERAL / 15-MINUTE PRESENTATIONS

G01

Influence of prey availability on home range size of Saker Falcons provisioning nestlings in Mongolia

Batbayar Bold[1,2*], Gankhuyag Purev-Ochir1[3], Amarsaikhan Saruul[1], Lutfor Md Rahman[4], Nyambayar Batbayar[1], Xiangjiang Zhan[2], Andrew Dixon[5]

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In order to better understand factors influencing home range use by Saker Falcons (*Falco cherrug*), we deployed satellite-received GPS transmitters on 12 breeding adults and tracked their movements during the nestling stage of the breeding cycle in 2009 and 2010. The Saker Falcons were breeding at six grids of 25 artificial nests, each erected in a 5×5 array with 1 km spacing, in the steppe habitat of two districts in central Mongolia. We estimated the availability of small mammal prey in each artificial nest grid using transect counts of active rodent holes. Saker Falcon pairs exclusively occupied the same home range area while provisioning nestlings, with virtually no overlap in range use between neighboring pairs. Male home range size was broadly consistent during the whole nestling period, whereas female home range size increased during the late nestling period after nestlings no longer required brooding. Home range size was negatively related to prey availability, where Saker Falcons breeding in artificial nest grids with high rodent availability had smaller home ranges than those breeding in grids with lower rodent densities. Variation in food supply is an important factor determining home range size, and the territorial exclusion of congeners can limit the breeding density of Saker Falcons.

G02

Assessing the effects of thermal factors on the spatial ecology of a critically endangered African vulture

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In the last three decades, African vulture populations have declined by over 80%. This is concerning as vultures efficiently clean ecosystems, thereby halting the spread of serious communicable diseases. Currently, conservation efforts for African vultures focus on poisoning, but climate change is also likely to have substantial effects on these species, particularly in the southern part of their range. These birds rely on soaring as part of their foraging habits, exposing them to extreme temperatures. Further, many of these species use exposed nest spaces, in the crown of trees or on exposed cliff spaces. Vultures are winter breeders to mitigate this heat exposure. As temperatures increase this exposure may become more extreme, and may reach a point where it negatively affects ability and success of breeding. To conserve vultures, it is imperative that we understand how climate change might impact their habitat use, so that appropriate steps can be taken to safeguard their long-term needs. African White-backed Vultures (*Gyps africanus*) are an indicator species, found across most of sub-Saharan Africa, and their wide ranging behavior can be indicative of broader landscape changes. This project will use GPS tracking and breeding survey data combined with distribution modelling to understand the effects that rising global temperatures and associated climatic changes, may have on African White-backed Vulture movement ecology, behavior and breeding across the southern African subregion. This presentation will focus on the preliminary results of my thesis and the next steps for the project.

G03

Insights in the movement ecology of Pueo (Hawaiian Short-eared Owl) in Hawai‘i.

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Short-eared Owls (*Asio flammeus*) are a globally distributed species with populations found in all combinations of temperate, tropical, continental, and island systems. The Pueo (*Asio flammeus sandwichensis*) is an endemic subspecies of Short-eared Owl, which suspected population declines have resulted in its state-listing as endangered on the island of O‘ahu and its recent listing by the U.S. Fish and Wildlife Service’s as a Bird of Conservation Concern. However, despite increasing concerns, this ground-nesting raptor remains understudied and basic information about their ecology is limited, including their movement patterns. In 2021, and for the first time, six Pueo were captured on O‘ahu, of which five were tagged with

GPS-VHF transmitters. On average, Pueo were monitored for 134±66 days and 631±308 locations were collected per bird (total of 3,156 locations, range: 129-977). Our results showed considerable variation in terms of movement patterns, habitat use, and home ranges by individuals. Pueo frequently used "natural" habitats during daytime, in contrast to higher use of agricultural fields, managed grasslands or urban areas at night. Some birds exhibited localized movements (within 10 km) while others travelled longer distances (up to 45 km), including visits to other islands (Molokaiʻi, 80 km away). Inter-island movements of Pueo were suspected but had not yet been documented using tracking devices. Our results represent a major step towards a better understanding of Pueo movement ecology, population size and dynamics, and has critical implications for improving the conservation of Pueo across the entire Hawaiian Archipelago.

G04

To cross or not: what conditions facilitate a crossing attempt of a soaring migrant in the Straits of Mackinac?

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The Great Lakes in North America are a formidable ecological barrier during migration. The expanses of open water pose a substantial obstacle for soaring migrants that rely on favorable atmospheric conditions and thermals to minimize energy expenditure. Due to the convective properties of water, thermals are usually poor or absent over open water causing soaring migrants to seek out the shortest distance of water to cross. The Straits of Mackinac in Northern Michigan are a 5.6 km waterway separating Lake Michigan and Lake Huron, forming an important migratory bottleneck used by tens of thousands of raptors during migration. To our knowledge, no studies have investigated what environmental conditions elicit a crossing attempt of a soaring migrant during northbound migration at this bottleneck. Successfully crossing the Straits is important and failing to do so could have delayed fitness consequences for migrating hawks. We deployed 36 GPS/GSM transmitters on adult Red-tailed Hawks (*Buteo jamaicensis*) during spring migration for three seasons (2021-2023). We recorded a total of 55 crossing attempts, with 23 having high GPS resolution. We modeled the crossing behavior against various environmental predictors to see which conditions facilitated a crossing attempt. Preliminary results indicate that wind direction is a significant predictor for when a hawk will attempt a crossing. We found thermal potential ΔT was not a significant predictor. Our findings suggest that favorable winds are key in helping soaring migrants conserve energy and may play a role in migration routes, timing, and strategy for Red-tailed Hawks.

G05

Northern Hawk Owl winter habitat use and movement in Minnesota and Manitoba

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Northern Hawk Owls (*Surnia ulula caparoch*) are one of the least studied birds in North America. Like many boreal forest species, the global range of Hawk Owls is predicted to shrink dramatically as northern forests recede in response to climate change. Conservation of Hawk Owls requires the understanding of Hawk Owl habitat use and range during the annual cycle, including activity in winter conditions. Although many unknowns exist for this species, winter research is a top priority. Little is known about how far individuals travel from their breeding/natal grounds or whether they establish a winter territory. We implemented the novel use of GPS/GSM transmitters to monitor the activity and movement of 11 Hawk Owls in northern Minnesota and southern Manitoba. The data from these individuals was used to determine if they had a winter home range and if selection occurred based on habitat variables. eBird occurrence data was used to create a species distribution model (SDM) through maximum entropy modeling to provide insights into land cover use and to identify which variables showed a higher habitat suitability index. Winter home ranges were smaller than expected (range: 2.11-34.75 km$^{2)}$ and were distinct from breeding ranges. Additionally, Hawk Owls selected for wetland habitat and were positively associated with edge characteristics in both analyzes, but wetland habitat mattered more in Minnesota compared to Manitoba. Our results provide novel data on Hawk Owl winter habitat use and highlight the importance of winter data for informing monitoring and land management plans.

G06

Breeding biology and migration ecology of Turkey Vultures in western Montana

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In recent decades, Turkey Vulture (*Cathartes aura*) populations have both increased and expanded northward in western North America. At our annual fall migration count site in the Bitterroot Valley of western Montana, the number of vultures seen per 100 observation hours more than tripled from an average of 174 birds in the first four years of the count (2011-2014) to 581 birds in the last four

years (2019-2022). Given their recent population growth and expansion in the west, coupled with knowledge gaps in Turkey Vulture breeding biology and migration ecology, we outfitted more than 50 birds with GPS transmitters over the last five years to better understand the western subspecies of Turkey Vulture (*C. a. meridionalis*). We discuss our early findings from this project, including the timing, distance, and fidelity of migration routes, home range size and habitat use on breeding and wintering grounds, and the difficulty in identifying and locating breeding individuals. We also touch on ecotoxicology, morphometric variation between sexes and populations, communal roost ecology, and sources of mortality, including the second documented case of a Golden Eagle (*Aquila chrysaetos*) predating a Turkey Vulture.

G07

Nest reuse patterns for four species of raptors in Southern California across seven years of the Los Angeles Raptor Study

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The Los Angeles (LA) Raptor Study is a community science based study of nesting raptors in the LA area, supported by Friends of Griffith Park. By documenting and tracking raptor nests across LA, we hope to understand how ecological dynamics change from year to year in the natural and built areas of LA, in particular how human activity is impacting wildlife. The data contained in our annual reports represent the first comprehensive dataset of an entire zraptor community in the urban core of LA. Some study nests are in natural areas and parks, however, most nesting sites monitored are found around single-family homes and yards, and many nests are located in street trees, backyard trees, or those along utility easements through residential areas. Nests are located through surveys by the study leadership team as well as outreach and tips from residents, and are monitored by dozens of trained volunteers. We will analyze and report on nest reuse patterns and nest switching between species across seven years of data from the study for the four most common raptors in the area: Red-shouldered Hawk (*Buteo lineatus*), Red-tailed Hawk (*Buteo jamaicensis*), Cooper's Hawk (*Accipiter cooperii*), and Great Horned Owl (*Bubo virginianus*). Other species nesting in the area include Barn Owl (*Tyto alba*), Western Screech-Owl (*Megascops kennicottii*), Peregrine Falcon (*Falco peregrinus*) and American Kestrel (*Falco sparverius*), but numbers of these nests in the study are too small for meaningful analysis.

G08

Nest success of Bald Eagles exposed to anthropogenic activities in the United States

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Increasing anthropogenic pressures can negatively impact avian populations. However, the Bald Eagle (*Haliaeetus leucocephalus*) population in the United States is demonstrating significant growth, with breeding pairs now colonizing areas of high human activity. We assessed the effects of anthropogenic activities on Bald Eagle nest success using data from U.S. Fish and Wildlife Service permits authorizing unintentional disturbance of breeding Bald Eagles. We used generalized linear logistic regression models in a Bayesian framework to evaluate the relationship between types of human activity, levels of human development around nests, and physical alteration of surrounding habitat. Mean nest success during authorized activities was 84% (95% credible interval: 76%-90%) and nest success was similarly high (77%-100%) among all activities and nest environments (P>0.6). Nests that were monitored prior to and/or after years of authorized activity exhibited similar success during the years for which disturbance take was authorized. The top model was the null model (AIC weight=0.47) and the next three models included activity type and habitat alteration covariates (total AIC weight=0.52). The only parameters with 95% credible intervals that did not encompass zero were infrastructure and landscape modification activities, for which all nests exposed to these activities were successful. However, parameter estimates had very high uncertainty, suggesting the covariates we evaluated were weak predictors of nest success. Our analysis suggests that the growing population of Bald Eagles nesting in human-developed environments tolerates anthropogenic activities with nest success rates comparable to the general USA population (often >80%).

G09

Productivity and nest survival of White-tailed Hawks in south Texas during the 2021-2023 breeding seasons

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The White-tailed Hawk (*Geranoaetus albicaudatus*) is a neotropical bird of prey that has a restricted breeding range in the United States, concentrated in the Gulf Coast of

Texas. Population estimates and demographics are largely unknown, which pushes the state-threatened listing of this species. Previous estimates of White-tailed Hawk nesting success show high variability both spatially and temporally. Further investigation of their breeding success will expand our current understanding and can be used in conservation planning for the species. We observed 80% breeding success from monitoring 40 different White-tailed Hawk nests along the coast in south Texas during the 2021 and 2022 breeding seasons. Overall, 0.677 nestlings were produced per breeding attempt, and 0.581 nestlings survived to fledge per breeding attempt. We found that the estimated daily survival rate increased in relation to nest height. At the average nest height of 3.54 m, our estimated daily nest survival was 0.9969 (95% CI=0.9898-0.9990), which results in an estimated nest survival of 77.8%. Our results are at the high end of previously reported estimates. This could be attributed to the broad spatial distribution of our sample that may conceal any localized patterns of nesting failure or to the temporal period in which we collected data compared to studies conducted in previous years. Data collection regarding productivity and nest survival is ongoing for the 2023 breeding season. Future analyses will further investigate potential variation in nest survival, incorporating environmental factors and latitude.

G10

American Kestrel nest survival and productivity across a decade in the Southern High Plains of Texas

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American Kestrel (*Falco sparverius*) populations are declining across much of North America and it is a species of increasing conservation concern. One region in which the species appears stable is in the shortgrass prairie of the Southern High Plains. In this region, we have monitored occupancy and reproduction of American Kestrels in a nest box program from 2014-2023 in Lubbock County Texas. Among 32 initial nest boxes, we observed an occupancy increase from 12% during the first year of the nest box program to as much as 73% in subsequent years. From 2014-2022 (data for 2023 is pending for analysis and inclusion in presentation) we monitored 158 known fate nest attempts. Observed nest success from 2014-2022 averaged 79%, but the modeled daily survival rate averaged 0.9954 (range=0.9911 to 0.9979), with modelled nest survival averaging 76.5±8.3%. Across 10 breeding seasons, average clutch size was 4.6±0.32 eggs, with 3.8±0.41 nestlings per hatched clutch, and 3.3±0.51 fledglings per successful nest; 391 fledglings were produced during the 2014-2022 study period. Kestrel populations that use artificial cavities are reported to experience nest success rates of 49-73%. Our population has high nest success which might be due to suspected site- and pair-fidelity and the nesting experience of pairs, favorable climate, and extended breeding season. We will include 2023 data for a final analysis of productivity and examination of multiple covariates to better assess drivers of daily nest survival.

G11

Land-use preferences of two Argentinian Caracaras

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Land use changes related to agricultural intensification and habitat homogenization rank high among the causes of biodiversity loss worldwide. The ability of species to adapt to living in humanized environments will determine their success in the current scenario of global change. Caracara species are generalist raptors that have been loosely identified as winning species in the face of agricultural intensification. However, their habitat preferences and the extent to which they might benefit from human activities are not well known. We conducted 891 point-count surveys in Pampa and Espinal ecoregions of central Argentina to describe the habitat use of the Argentinian caracaras, Southern Caracara (*Caracara plancus*) and Chimango Caracara (*Milvago chimango*). We found that Chimango Caracara was the most ubiquitous (82.15% occurrence) and abundant species (mean=4.03 individuals [SD=6.92]) by point count, versus Southern Caracara (21.89% and 0.46 individuals [SD=1.81], respectively). Both species showed a low dependence on the type of land use, although they showed opposite preferences. Chimango Caracara were more abundant in crops different from soybean, and in exotic tree plantations, whereas Southern Caracara were more abundant in pastures, soybean crops and areas with native forest. Our findings suggest that the response to agricultural intensification has been species-specific, potentially affecting both the spatial distribution and long-term population dynamics of these species.

G12

Swainson's Hawk philopatry and nest-site fidelity result in ecological trap

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From 1997 to 2022, we studied natal and breeding dispersal of Swainson's Hawks (*Buteo swainsoni*) in the Antelope Valley of the western Mojave Desert, banding 198 nestlings and 21 adults. Of the 198 nestlings banded, 29 (14.6%) were later encountered within the study area. Twenty-five of the 29 were encountered on breeding territories with natal dispersal distance ranging from 1.6-45.6 km (median=9.8 km, mean=16.7±13.3 km, N=25). Three hawks with dispersal distances <3 km nested in territories directly adjacent to their natal territories. Of the 219 banded hawks, we later encountered 21 in more than 1 year (mean=2.4±1.7 years, range=1-6 years, N=21) in

the study area. Eighteen of the 21 hawks were confirmed as breeders and included in the analysis. Seven hawks exhibited 10 (20.1%) territory changes among 48 breeding dispersal opportunities. Breeding dispersal distance ranged from 0.7-8.3 km (median=1.2 km, mean=2.0±2.3 km, N=10). The median natal dispersal distance of 9.8 km indicates that the population is philopatric while the shorter breeding dispersal distances (median=1.2 km) indicate a strong degree of nest-site fidelity. As this population is both philopatric and faithful to their breeding territories, individuals may be closely related assuming limited immigration. Considering the level of philopatry and strong nest-site fidelity of Swainson's Hawks and the rapid expansion of utility-scale solar energy development occurring in the Antelope Valley, this population of Swainson's Hawks may now be experiencing a form of "philopatric" or nest-site fidelity induced ecological trap.

G13

Ferruginous Hawk home range and habitat use in western Wyoming

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The Ferruginous Hawk (*Buteo regalis*) has historically been considered highly sensitive to human disturbance. However, the effects of oil and natural gas activity on Ferruginous Hawks are poorly understood largely because no studies have been able to assess habitat use both before and after development occurs within a singular study area. A large natural gas development project has been approved in Sublette County, Wyoming in a landscape with breeding Ferruginous Hawks. The objective of our study was to identify the biotic and abiotic factors associated with Ferruginous Hawk home range size and habitat use prior to a large-scale energy development, with the goal of informing mitigation measures. Between 2019-2022, we outfitted 14 breeding adult hawks, consisting of eight males and six females, with GPS transmitters set to gather locations at regular intervals during daylight hours. Home range sizes were calculated using minimum convex polygons (MCP), kernel density estimation (KDE), and autocorrelated kernel density estimation (AKDE) methods, with 95% defining home area and 50% defining core area. Male home ranges were larger than females for all three home range estimation types. Males averaged 25.67 km^2 for 95% AKDE while females averaged 12.33 km2. Resource selection function analyses incorporated both remotely sensed data and field collected data (e.g. prey availability), using a use-available design within the 95% AKDE home range. Understanding these important habitat requirements prior to large-scale energy development is imperative to reducing potential impacts from energy extraction activities to Ferruginous Hawks and other raptors of conservation concern.

G14

GPS satellite tracking of Sharp-shinned Hawk in western North America

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The Sharp-shinned Hawk (*Accipiter striatus*) is one of North America's most observed raptors at migration count sites. However, the 2019 Raptor Population Index trend results indicate declines at 50% of count sites over the past 20 years, and also the diurnal raptor species with the most widespread declines over the last decade. Outside of migration, the Sharp-shinned Hawks' small size and secretive nature make them a challenging study species, and thus, there are many knowledge gaps about migration routes, breeding, and wintering grounds. Furthermore, their small size typically precludes them as suitable candidates for satellite telemetry. HawkWatch International deployed three 5 g ICARUS transmitters on adult female Sharp-shinned Hawks captured during the fall 2021 migration as part of the 'Room to Roam: Yellowstone to Yukon Wildlife Movements study'. Our goal was to gain insight into the migratory movements and behaviors of this understudied and declining species. We successfully collected fall and winter movement data from all three individuals tagged at the Goshute Mountains HawkWatch and tracked them to Arizona, USA, Sinaloa, and Durango, Mexico. The ICARUS's receiver is located on the International Space Station and requires collaboration with the Russian Space Agency for successful data downloads, but unfortunately, we received no additional data from the units after March 2021 due to the Russia-Ukraine conflict. Though we are disappointed in this study's unexpected and abrupt conclusion, we believe this initial effort of GPS tagging Sharp-shinned Hawks provides valuable insights into a species with increasingly high research and conservation priority.

G15

Close to home or room to roam: do space use and nest metrics of nesting American Kestrels vary by landscape?

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Habitat quality and composition influence species movement, time budgets, and energetics, which can affect reproduction and survival. American Kestrels (*Falco sparverius*) are a generalist species, nesting across different human-dominated landscapes. We studied space use of nesting American Kestrels nesting in the Greater Salt Lake region of northern Utah and the relationships between movement and productivity along an urban gradient. We deployed GPS tags on breeding pairs at 25 nests in residential, commercial, urban park, wildland, and agricultural land cover

types. We recorded the clutch size, brood size, nestling weight, number of fledglings, and adult weight change from GPS tag deployment to retrieval. We predicted that the home range size of adults would vary across land cover types and adults with larger home ranges would have lower productivity and higher weight loss over the season. Results will provide new insight into American Kestrel movement and productivity in urban environments.

G16

Winter refuge in the Lone Star State: examining American Kestrels' habitat use in North Texas

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American Kestrel (*Falco sparverius*) populations have declined >50% since the 1960s, with likely causes suspected to occur in the understudied winter and migratory periods. To better understand the ecology of a hotspot of wintering kestrels, we examined the habitats used and selected by a kestrel population in North Texas. Our primary objectives were to examine primary and diversity of land cover, percent tree canopy cover, distance to water, and percent imperviousness as a measure of urbanization in a proxy kestrel territory area. Since the winter of 2016-2017, we have captured and uniquely banded over 400 kestrels in Denton County. The aspects of habitats were quantified within a circular proxy territory of 0.5 km^2 and a 1 km2 landscape buffer around the site of capture for each banded bird. Utilizing NLCD Land Cover Data, we found that most kestrels preferred primary habitat types including grassland/herbaceous, pasture/hay, and cultivated crops with typically six to nine habitat types within each proxy territory. The tree canopy cover within a kestrel territory averaged 3.3% with a median of 0.6% and a range from 0-56.8%. On average, kestrels inhabited a territory that was 723 m from the nearest open water source. Over half of all individuals preferred habitats with less than 5% imperviousness, though percent imperviousness ranged from 0-72%. Our data suggests that wintering kestrels in north Texas are mostly selecting and using territories with mostly open and grassland habitat, avoiding tree cover, and with a limited amount of developed urban habitat.

G17

Seasonal home ranges and migration of Zone-tailed Hawks from the Trans Pecos of Texas

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Within the United States, Zone-tailed Hawks (*Buteo albonotatus*) are an uncommon raptor found in the arid southwest where it is rare and diffuse. The existing quantitative information is limited to nesting– with the species being associated with riparian systems– but also found nesting at high elevations in pine forests and on cliffs. Nothing is known of the species movement patterns, home range sizes, migration, or the wintering area of migrants. There is a poor understanding of the species ecology, habitat requirements, and conservation needs. In 2021 we initiated a study using GPS transmitters to determine breeding and wintering home range sizes, habitat associations, and migration timing and paths of Zone-tailed Hawks nesting in the Trans-Pecos region of Texas. Our GPS tagged birds are providing the first quantitative information on these parameters for the species. Initial data suggests breeding season home ranges in the Trans-Pecos region exceed 500 km^2, with males making multiple daily foraging bouts that can exceed 20 km from the nest. Tagged hawks used similar migration routes for both spring and autumn migrations and wintered in Central American countries. Winter home ranges were distinct but as large as 390 km2. To date the tagged hawks have demonstrated high fidelity to both summer and winter home ranges, although samples are limited. Our ongoing study will provide data with which state wildlife management agencies can make informed status and management decisions. This is especially important in Texas where the Zone-tailed Hawk receives state protection as a threatened species.

G18

Housing the Barred Owl in Alberta, Canada's boreal and foothills

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As an obligate cavity nester associated with older mixedwood forest and year-round resident, the Barred Owl (*Strix varia*) has been selected as an indicator species by Alberta Environment and Parks (AEP). A project was initiated by West Fraser and Weyerhaeuser forest companies, and STRIX Ecological Consulting in managed forests of Alberta's boreal and foothills. The goals were to determine Barred Owl occupancy and nesting success, collect detailed habitat information in Barred Owl territories, and test a model developed by AEP. To date, 35 Barred Owls (23 female/12 male) have been fitted with Lotek PinPoint VHF 240 satellite transmitters. Fourteen nests have been found, 10 in balsam poplar natural cavities and four in trembling aspen (three natural cavity and one broken top bowl). 28 owls have been carrying transmitters for over a year and have over 600 locations each. Mean female breeding season home range was smaller than males, and winter ranges were larger for sexes. Some Barred Owls made winter forays out of territory in the winter on multiple occasions. One owl moved over 20 km, assumed a winter territory, and moved back to the

breeding territory in the following year. Seven transmitters failed, were dropped, or could not be located, but some could have moved too far to detect. Habitat selection and territory longevity will be analyzed this fall and data will be presented. Satellite and VHF technology offer great insights into the movements of Barred Owls, and data can be downloaded remotely reducing researcher intrusion.

G19

Distribution, nesting records and notes on the ecology of the White-throated Caracara

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Endemic to Patagonia, the White-throated Caracara (*Phalcoboenus albogularis*) is one of the least studied caracara species, with several aspects of its ecology, such as breeding biology and diet, largely unexplored. Taking advantage of opportunistic observations on touristic travels and during fieldwork with other taxa in the species distribution area, we collected data on breeding biology, nesting sites and diet of the species. We also created the first distribution model using citizen science data. We recorded 24 White-throated Caracara nests in Chile and Argentina. Nests were located at 1038.04±89.57 m above sea level (mean ± SE; N=23, range 20-1963) in rocky outcrops and cliffs of 42.59±9.79 m (range 4-200, N=22) and at 28.00±5.72 m (range 3-100, N=22) from the base of the cliff. The species nesting season starts in September and ends in March, although with some regional variation. The modal brood size is of two fledglings and most nests seem to be used yearly and breed successfully. The species predominantly occupies the highland plateaus of Austral Patagonia, the Andes Range up to 41° South, and southern Tierra del Fuego. The breeding and winter range models indicate a consistent distribution without significant latitudinal changes and a small transition to lower elevation grounds to the east of the Andes in winter. The White-throated Caracara remains a poorly known scavenger in southern South America and requires further attention to ensure the preservation of its critical ecological functions in Southern Patagonia

G20

Breeding distribution and threats for the endangered Black-and-Chestnut Eagle in Argentina

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The Black-and-Chestnut Eagle (*Spizaetus isidori*) was first discovered in Argentina in 1954 through a collected individual. Another individual was collected in 1956, then, with no records for 30 years the species was considered locally extinct in 1985. However, in July of 1987 the species was recorded again. Since then, several records indicated that this endangered species was distributed through the Yungas of Argentina. In 2014, the first nest was found. Here we report data on breeding ecology, diet, dispersal and potential threats gathered in that single nest for eight years, as well as the finding of eight additional nests of this species. The Black-and-Chestnut Eagle has been confirmed to nest in three of the four provinces with Yungas forest of Argentina. Its nesting season may start from late April to the first week of August and ends from mid-September to late December. The breeding rate was 0.71 nestlings/nest/year in the first nest, but with additional nests the breeding rate dropped to 0.47. This species feeds mostly on guans and eventually chickens and other raptors. Data gathered in the last years suggest that unnoticed human mediated mortality could be higher than expected. The dispersal movement of juveniles suggests the eagles can move through large areas but they suffer a high mortality. The monitoring of new nests will improve our understanding on the species ecology and its conservation status in northern Argentina.

G21

Current status of breeding population of Western Osprey in Abu Dhabi, United Arab Emirate

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Western Osprey (*Pandion haliaetus*) is a resident breeding species in the United Arab Emirates (UAE). Osprey breed from December to March on the offshore and near-shore islands and coastal sites across the country and about 90% of the breeding population is found in Abu Dhabi Emirate. It is one of the regional priority species identified for conservation in the UAE and listed as an endangered species by the Abu Dhabi Red List of Species. During 2023, an Emirate-wide

comprehensive survey was conducted for the first time, covering all coastal sites, as well as nearshore and offshore islands in Abu Dhabi. This is the first such comprehensive survey for breeding Ospreys in the UAE. Data was collected using a customized mobile application in aquatic ecosystems and efforts were made to geo-reference and photograph all the nest structures. Of the 334 nests, we were able to locate across more than 55 coastal and island sites, 127 were active. Moreover, 32% (N=41) of the active nests were recorded on the artificial platforms installed at different breeding sites to aid nesting. The breeding population of osprey in the UAE is estimated to be 110 breeding pairs. The study established that the current breeding population of ospreys in the Abu Dhabi Emirate stands at 127 breeding pairs. A stable breeding population of osprey indicates the health of UAE's coastal and marine environments. Environment Agency – Abu Dhabi continues to monitor and enforce protection measures to ensure the conservation of this regionally important species and its habitats.

G23

A novel approach to the nest site characterization of two species of critically endangered vultures

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Vulture populations in Africa face extinction as the result of numerous human-generated threats. Existing geographical and ecological knowledge gaps urgently need filled to target conservation action across the vast continent, and ideally halt further decline. Our study focuses on two Critically Endangered African vulture species - the White-backed Vulture (*Gyps africanus*) and the rare, poorly understood White-headed Vulture (*Trigonoceps occipitalis*) - in one of the most understudied countries, Mozambique. Formal documentation of breeding densities, basic nest site characteristics, and timing is limited for both species within Mozambique. To fill this gap, we employed a novel survey method using an Unoccupied Aerial System, or drone, to monitor, collect data, and map nest sites in 2021 and 2022. We found nest tree species, nest tree height, and surrounding vegetation heights to be defining nest site characteristics at 49 White-backed and 27 White-headed Vulture nest sites. Both species nested in trees averaging ~21 m in height, but White-backed Vultures exhibited high use of African fan palms, while White-headed Vultures nested primarily in baobab trees. Canopy Height Model analysis revealed both species mostly nested in the tallest trees and in areas with a high degree (70-81%) of low vegetation (<5 m) within a 65 m radius around the nest tree. Patterns in three fine-scale spatial buffers, or areas of vegetation clearance around each nest, emerged. Used together, these key characteristics can be used to inform managers of known locations, identify local threats, and predict new vulture nesting hotspots.

G24

A review of the effects of wind farms on raptors and potential mitigation strategies

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Wind farms are a clean and efficient source of renewable energy. However, they cause negative impacts on raptors. In this communication, we review the existing scientific literature on the effects of wind farms on raptors' ecology with a particular interest in the potential solutions to avoid negative impacts. After collecting 155 studies, we found a consensus in the literature that raptors exhibit avoidance behaviors and that the abundance of raptors decreases after wind farm installation, although it might recover over time. The location of wind farms on mountaintop ridges poses a particular danger to large soaring raptors, as they rely on topographic updrafts to gain altitude. Adult mortality significantly affects population dynamics, particularly in endangered species, but young inexperienced individuals show a higher collision risk. The combination of different methods including field monitoring, GPS telemetry, and systematic search for carcasses is an adequate approach to further investigate the problem and solutions. Shutdowns on-demand, the installation of deterrents, and the repowering of wind farms have been suggested as potential solutions, although results remain controversial and case-specific. Furthermore, it is essential to report the potential occurrence of conflicts of interest in scientific papers, although nobody does so, as they can influence the interpretation of the results. Finally, from a future perspective, it is crucial to assess the effectiveness of solutions to mitigate the negative effects of wind farms to promote raptor conservation. This becomes increasingly relevant in the context of renewable energy development and increasing energy demand worldwide.

G25

Data-driven predictive movement model for raptors using look-ahead environmental conditions

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We present a movement model for predicting Golden Eagle (*Aquila chrysaetos*) movements at 1 Hz temporal resolution trained using telemetry data from the western and eastern USA. The telemetry data is first segmented into tracks containing consistent flighted movement. These tracks are resampled using a Kalman smoother to produce positional and other higher-order movement data at 1 Hz resolution. These resampled tracks are then annotated with topographical and environmental data such as ground elevation and wind conditions. A stochastic movement model is proposed to model

horizontal and vertical movements as a function of current and look-ahead conditions, whose parameters are tuned using the resampled and data-annotated tracks. Model validation is performed by simulating 100 tracks from the same location as the test track, then computing the average radial distance between the simulated tracks and the actual tracks at multiple time instances. Preliminary results show that about 75% of the time the calibrated model can predict the movements within 1 km of the actual track, at 3 mins from the start. Such models can be deployed in the field to augment raptor detection technologies at wind farms to accurately predict the turbines in conflict. In this talk, we will present the mathematical apparatus of the model, the telemetry data used in calibration, and the validation results. We will also discuss possible uses of the model within the context of wind energy, and how models like this can help the smart curtailment strategies currently in practice at wind farms.

G26

Using GPS tracking to understand, map, and mitigate wind turbine collision risk for raptors

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The wind energy industry is growing rapidly worldwide in response to the need for sustainable energy. Large soaring raptors are killed when they collide with wind turbines, presenting a green-green dilemma. To reduce raptor collisions, turbines should be built at locations which are least used by sensitive species, and curtailed when collision risk is particularly high. This can be achieved by understanding species-specific spatiotemporal drivers of space use. We show how GPS tracking data can be used to build collision risk models for a large soaring territorial raptor, the Verreaux's Eagle (*Aquila verreauxii*). Using tracking data from 15 eagles, we built a predictive model using the location of nests and landscape variables to determine spatial collision risk. The model can be applied to new wind energy developments to understand risk early in the planning process. Mapping collision risk rather than excluding development from traditional circular buffers around nests, resulted in ~5% improvement in eagle protection while excluding development from the same area (but not shape). For an equal level of eagle protection, our model can provide ~21% more land available for development compared to a circular buffer. For a wide-ranging colonial species, the Cape Vulture (*Gyps coprotheres*), we demonstrate how a similar approach using tracking data to map risk across the entire range of the species can also be used for strategic large-scale planning. Lastly, we discuss examples using Black Harrier (*Circus maurus*) tracking data to determine temporal curtailment or shutdown on demand to reduce risk of operational turbines.

G27

Using GPS tracking of Martial Eagles to inform future wind farm development

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The wind energy industry's rapid expansion worldwide to meet the demand for sustainable energy sources has led to an unintended ecological dilemma. Specifically, the unfortunate collision of large soaring raptors with wind turbines presents a complex and intricate challenge in the pursuit of both green energy production and the preservation of avian populations. By specifically targeting pre-construction initiatives, our objective is to predict potential locations for reduced utilization thus minimizing mortality risk to sensitive species. Using tracking data from 23 individual Martial Eagles (*Polemaetus bellicosus;* N=14 females and nine males) ranging across South Africa, we demonstrate the application of GPS tracking data in constructing collision risk models. Our investigation delves into the spatial ecology of two distinct populations, one inhabiting the protected boundaries of Kruger National Park (average 95% KUD home range 100 km^2), while the other exists in the arid human-modified Karoo region (average 95% KUD home range 300 km2). To enhance the accuracy of our risk assessment, we incorporate breeding status, considering their characteristic reproductive behavior of breeding every other year, as well as their utilization of alternative nest sites. The latter is particularly noteworthy due to the prolonged multi-decadal lifespan of wind farms. By adopting a collision risk mapping approach, instead of employing circular buffer zones around nests to restrict development, we can simultaneously augment raptor conservation efforts and expand the land area available to wind energy projects.

G28

Summarizing publicly available raptor fatality reports from wind farms across the contiguous United States and Canada

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Wind energy is an important resource for moving towards a sustainable future, but this technology is also a known hazard for raptors. Research has mostly focused on documenting fatalities and impact at individual wind farms, particularly to determine annual mortality. Review and synthesis papers tend to focus on aggregating annual mortality information across large landscapes or to assess the risk for individual species of conservation concern. What is lacking in the scientific literature is an aggregation of known fatality data

across the United States and Canada. This is difficult to summarize, because survey data are not mandated to be made publicly available. These data, however, are essential for understanding the real impact of wind energy development to raptor communities, particularly for those species most affected. We searched databases for public reports containing raptor fatality data from wind farms across the contiguous US and Canada, as well as for papers that summarized fatality data from multiple resources including those not yet available to the public. Within 89 sources, we found evidence of more than 3,300 raptor fatalities, with 68% occurring at the Altamont Pass Wind Resource Area. We suggest species at greatest risk are Red-tailed Hawks (*Buteo jamaicensis*), American Kestrels (*Falco sparverius*), Golden Eagles (*Aquila chrysaetos*), Burrowing Owls (*Athene cunicularia*), Turkey Vultures (*Cathartes aura*), and Barn Owls (*Tyto alba*). Importantly, we could not find reports from the vast majority of wind farms, and we are therefore still lacking substantial fatality data that could be useful in risk assessment.

G29

Cryptic population response of Golden Eagles to wind-energy production in an oak savannah landscape

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The Diablo Range of west-central California supports one of the densest known breeding populations of Golden Eagles (*Aquila chrysaetos*) in the world. This region includes the Altamont Pass Wind Resource Area (APWRA), where collisions with wind turbines constitutes a sizable source of mortality for Golden Eagles. During 2014-2022, we used a broad-scale sampling design to monitor population status of Golden Eagles across a 5,170 km^2 region including the APWRA. We identified as many as 230 territorial pairs of eagles, 21 of which overlapped with the APWRA in any given year. On average, the density of eagle pairs detected within 2 km of wind turbines at the APWRA (1 pair per 17.8 km2 surveyed) was similar to that estimated in surrounding landscapes (1 pair per 20.3 km^2). Eagle pairs monitored in the APWRA also had similar reproductive output (0.37 young fledged per pair) relative to pairs outside of the APWRA (0.30 young fledged per pair). Despite these similarities, the occurrence of territorial pairs consisting of at least one subadult was substantially greater at the APWRA (mean=29% of 16 pairs aged) relative to pairs monitored in surrounding landscapes (mean=3% of 122 pairs), indicating a potentially higher rate of adult breeder mortality, turnover, or displacement at territories associated with the APWRA. This finding suggests that the population response of Golden Eagles to spatially localized hazards based on counts, reproduction, or distribution of territorial pairs may be obscured when not accounting for underlying changes in age structure.

G30

Automated curtailment proves effective at reducing Golden Eagle mortality at a California wind facility

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Wind turbine collisions are a significant source of Golden Eagle (*Aquila chrysaetos*) mortality in the Altamont Pass of California, USA. A pilot project at an Altamont facility tested Identiflight's automated detection and curtailment technology at reducing Golden Eagle mortality. Studies of Identiflight's effectiveness at reducing Golden Eagle mortality have been limited to a single wind facility in Wyoming, USA. We employed a Before-After-Control-Impact analysis to assess the efficacy of Identiflight. The Before dataset consisted of three years of intensive fatality monitoring before implementation of Identiflight, whereas the After dataset consisted of two years of monitoring after Identiflight had been optimized. Identiflight coverage was limited to the highest risk turbines and served as the Impact group. The remaining turbines were not fully visible to Identiflight towers and served as the Control group. The fatality estimation program GenEst was used to estimate median values of Golden Eagle fatalities/turbine/year. The mean estimate (and 95% CI) for the Impact group was higher than the Control group in both periods (Impact-Before=0.456 [0.216, 0.695]; Control-Before=0.200 [0.071, 0.328]; Impact-After=0.170 [0.015, 0.325]; Control-After=0.121 [0, 0.241]). However, the mean estimate for the Impact-After group was 60.6% less than would have been expected had it changed the same amount over time as the Control group. In other words, Identiflight reduced Golden Eagle mortality by 60.6% at Impact turbines, even after accounting for annual variation. The BACI Contrast showed a decrease of 0.207 Golden Eagle fatalities/turbine/year on average at Impact turbines compared to Control turbines.

G31

Distribution models and mapping tool for year-round prioritization of Golden Eagle habitat

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Broad-scale conservation of wildlife habitat requires spatial prioritization of the landscape as a key first step. Wyoming, USA, contains some of the most valuable areas for long-term conservation of Golden Eagle (*Aquila chrysaetos*) populations in western North America, but our ability to

identify and spatially prioritize important habitats within the state remains limited. Specifically, most efforts to prioritize landscapes for Golden Eagles have focused on breeding birds and nesting habitat. To address this information need, we created models of relative habitat importance that encompass all major Golden Eagle life-history groups and seasons across Wyoming. Through many collaborations, we compiled >9.5 million Golden Eagle locations from GPS telemetry and >2,500 nest locations. Using these data, a library of geospatial predictor variables, and machine learning algorithms, we developed high-resolution models that accurately predict Golden Eagle relative habitat suitability during the breeding, winter, fall migration, and spring migration seasons. We have incorporated these models into a web-based mapping and decision support tool (raptormapper.com) that will enable all parties involved in conservation and management of Golden Eagles in Wyoming to quantify the relative value of land parcels and incorporate spatial prioritization of seasonal habitats into their existing regulatory processes, land-use planning tasks, and conservation actions.

G32

Mitigating threats to nestling Golden Eagle survival and health: a prescription for the treatment of nest ectoparasites and disease

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Changes in biological communities, driven by land use and climate change, can affect disease infection rates and the distribution and abundance of parasitic species. Parasites negatively affect the growth of young birds and can have long-term consequences on health, fecundity, and survival. For example, a blood-sucking ectoparasite, *Haematosiphon inodorus*, and the disease trichomonosis cause the death of 30% of nestling Golden Eagles (*Aquila chrysaetos*) each year in southern Idaho. We aimed to develop a protocol for the treatment of *H. inodorus* in Golden Eagle nests and to treat eagle nestlings with symptoms of trichomonosis to improve the health and survivorship of young eagles. We collected information on nestling health and survival, estimated *H. inodorus* infestation levels, and, if necessary, treated nestlings for trichomonosis in the springs of 2021-2023. After the young left the nest, we applied one of three treatments (permethrin and diatomaceous earth, diatomaceous earth only, or water) to the most commonly used nests within a territory. We returned in subsequent years to measure the effects on nestling health and survival and *H. inodorus* infestation rates. We found that a combination of permethrin and diatomaceous earth significantly reduced the level of *H. inodorus* infestations in nests, which lead to improved indicators of health in eagle nestlings. Further, more than 10 nestlings survived trichomonosis after treatment. We demonstrate that the treatment of parasites and diseases provides reliable and cost-effective compensatory mitigation options for Golden Eagles that can have measurable outcomes for improving survival and improving population resilience

G33

Nest parasites reduce reproductive success in a recovering raptor population

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Ectoparasites including ticks, fleas, flies, and true bugs infest bird nests and can reduce nestling growth and survival. As the distribution and abundance of such nest parasites is altered by anthropogenic land use and environmental changes, assessing ectoparasite levels within threatened populations and understanding their impact on population dynamics is a necessary component of avian conservation. We evaluated the prevalence and implications of nest ectoparasites on Bald Eagles (*Haliaeetus leucocephalus*) breeding in Arizona. We found that argasid ticks (*Argasidae spp.*) and Mexican chicken bugs (*Haemutosiphon inodorus*) infested 4.4% of known nests and were present in 9.7% of breeding territories between 1987 and 2022. Nests on rocky cliff ledges were most likely to be infested. Nests with ectoparasites produced 46-47% fewer fledglings than nests without ectoparasites. However, our observed levels of nest infestation did not appear to strongly influence population-level reproductive success. Nonetheless, the large effect of ectoparasites on individual nests merits both continued monitoring and further investigation into methods for compensatory mitigation through prevention or treatment of nest infestations. We emphasize the importance of evaluating the individual- and population-level impacts of nest parasites on raptor reproductive success particularly in areas where ectoparasite abundance is likely to increase with climate change and other anthropogenic activities.

G34

Birds groom more in regions with higher parasite pressure: a comparison of temperate and subtropical American Kestrels

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Grooming behavior, which maintains and cleans the integument, is a widespread behavior of birds, mammals and arthropods. The extent to which grooming is influenced by large-scale environmental differences, such as geographical and seasonal variation, remains largely unexplored. We investigated spatial and temporal variation in the grooming behavior of American Kestrels (*Falco sparverius)*. Specifically, we compared the self-grooming behavior (preening and scratching) of kestrels in the subtropical Bahamas to kestrels in temperate northern Utah, USA, in both summer and winter. We also compared differences in parasite "pressure" by quantifying the prevalence and abundance of ectoparasitic lice (Insecta: Phthiraptera) on kestrels in both locations. Bahama kestrels had significantly more lice than Utah kestrels, which is typical of birds in humid regions, compared to arid regions. Bahama kestrels groomed significantly more than Utah kestrels, which may constrain the time-activity budgets of Bahama kestrels. Within each region, however, birds with more lice did not groom more. This pattern is consistent with geographical differences in programmed grooming, rather than stimulus-driven grooming. Kestrels in both locations groomed significantly more in summer than in winter, presumably because feather molt occurs in summer. To our knowledge, this study provides the first demonstration of geographical variation in the grooming behavior of any animal. Experimental studies are needed to confirm the causes and consequences of this variation.

G35

Grooming time predicts survival: American Kestrels on a subtropical island

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Animals have evolved a variety of adaptations to care for the body surface, such as grooming behavior, which keeps the integument clean, parasite-free, and properly arranged. Despite extensive research on the grooming of mammals, birds, and arthropods, the survival value of grooming has never been measured directly in natural populations. We monitored grooming and survival in a population of marked American Kestrels (*Falco sparverius*) on San Salvador Island, Bahamas. We found a strong association between time spent grooming and survival over a two-year period. The quadratic relationship we show is consistent with stabilizing natural selection on grooming time. To our knowledge, this is the first evidence for a correlation between grooming time and survival in a natural population. Grooming time may predict the survival of many animal taxa, but additional studies are needed to determine the shape and strength of the relationship among birds, mammals and arthropods.

G36

Emerging mortality in White-tailed Sea Eagle nestlings: apex-predators struggle with enzootic circulation of highly pathogenic avian influenza virus of subtype H5 (2.3.4.4b) in Europe

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European wild bird populations have been repeatedly affected by incursions of highly pathogenic avian influenza virus (AIV) of hemagglutinin subtype H5 (HPAIV H5). Currently, strains of clade 2.3.4.4b have attained an enzootic status in wild bird populations in Europe characterized by numerous cases and even mass mortalities among colony-breeding seabirds, also during spring and summer months. Due to their hunting and scavenging behavior, raptors typically represent secondary hosts at high risk of exposure, as a result of overall high infection pressure from prey infected with HPAIV H5. Since 2022, for the first time, an additional threat arose from the overlap of ongoing HPAIV H5 outbreaks with the breeding and hatching season of raptors (e.g. White-tailed Sea Eagles [*Haliaeetus albicilla]*). Our investigations confirmed the key role of raptors as suitable indicators for HPAIV H5 circulation and its genetic variety in Germany. We examined several HPAIV H5-related die-offs in White-tailed Sea Eagle nestlings in 2021 (N=2) and 2022 (N=7). Serological investigations revealed low detection rates of antibodies against AIV for two out of 40 (5%) nestlings in 2021 and six out of 76 (7.9%) nestlings in 2022.

However, findings in two individuals suggest that nestlings may overcome an infection with HPAIV H5, as they showed H5-specific antibodies or were observed becoming fledged after contact with HPAIV H5. Combined with an unimpeded breeding success rate, despite enzootic HPAIV circulation in our monitoring area in 2022, these findings raise hope for less severe long-term impacts on at least some populations of avian apex predators.

G37

Genomic signatures of selection for resistance to lead exposure in Turkey Vultures

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Turkey Vultures (*Cathartes aura*) are key scavengers in ecological communities, often feeding on carcasses left behind by hunters who use lead (Pb) ammunition. No information exists about genetic variation in susceptibility to Pb in vultures or whether long-standing exposure has exerted selection for increased resistance to Pb in any raptor. Here, we analyzed 10 Turkey Vulture genomes for signatures of selection by running neutrality and outlier loci tests. The results indicated balancing selection as the primary force acting on the genome. We also found high linkage disequilibrium and reduced genetic diversity along the genome, signifying that the species experienced a population bottleneck, in line with previous demographic studies. Through a comparison of the most recent NCBI Gene-Finding File (GFF) for the species and neutrality and outlier loci tests, we identified 212 regions of interest, which included genes involved in oxidative stress response, neurotransmitter communication, and voltage-dependent ion channels (K^+ and Ca^+). The involvement of these genes in an adaptive response to Pb exposure will need further confirmation, including through transcriptomic analysis of individuals varying in exposure to Pb. Further investigation by transcriptomic analysis will reveal which loci may be undergoing positive selection and will further confirm if the regions identified through genomic analyses are indicative of selection for Pb resistance. Our results will unveil how raptors respond to toxicological risk from Pb, and what the role is for evolution, as opposed to plasticity, in supporting the persistence of Turkey Vulture populations in the face of widespread Pb contamination.

G38

Lead and oxidative stress in migrant and resident Turkey Vultures in California

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Migration is energetically costly, often leaving birds in a deficit for fat stores and antioxidants. The Turkey Vulture (*Cathartes aura*) is an obligate scavenger with migrant and resident populations distributed across the Americas. Turkey Vultures are at risk of lead (Pb) toxicosis from ingesting Pb ammunition embedded in offal left behind by hunters. In 2019, California banned Pb ammunition for hunting purposes, yet migratory vultures are likely still exposed to Pb shot outside California. Additionally, oxidative stress (OS) from the energetic demands of migration may leave migrating vultures even more susceptible to Pb toxicosis. To test this, 41 resident and seven migrant Turkey Vultures were captured in Southern California between August 2020 and April 2021. Blood samples were tested for Pb concentrations and biomarkers indicative of oxidative stress including glutathione (GSH), the main intracellular antioxidant, and protein carbonyls (PC), a measure of oxidative damage. Migrants had blood Pb concentrations of 9.37 µg/dL (SD=2.62), which was higher than residents (2.41 µg/dL; SD=1.88). Among residents, PC levels were negatively correlated with GSH levels suggesting that as oxidative damage increases, GSH is depleted, while in migrants no correlation was found, potentially indicating an up-regulation of GSH levels in migrants. Higher Pb concentrations in migrants indicates greater toxicological risk for Turkey Vultures elsewhere within the species' range, especially coupled with the energetic demands of migration. This indicates a need for a flyway approach to conservation, as local environmental measures may inadequately address the conservation needs of migrants.

G39

Potential for lead exposure to scavengers utilizing hunter killed oryx on White Sands Missile Range, New Mexico

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Lead residues in the form of fragments, shot, or intact bullets from lead-based ammunition used to hunt or dispatch animals poses a risk for scavenging wildlife resulting in sublethal and sometimes lethal doses. To provide direction

in ecosystem management for White Sands Missile Range (WSMR) relative to the potential threat of lead poisoning in scavengers from ingesting the remains of hunted big-game carcasses, we deployed 479 motion triggered game cameras over the course of 18 WSMR controlled hunts from 2017 to 2020 and recorded visitations of scavengers to hunter killed remains of oryx (*Oryx gazella*). Species in photos were identified and visitation was quantified by assessing the percent of carcasses visited by each species overall and per season (summer, fall, and winter). Preliminary results from processing roughly 500,000 of the 750,000 photos taken show over 40 species observed including raven (*Corvus corax/ cryptoleucus*), coyote (*Canis latrans*), and Golden Eagle (*Aquila chrysaetos*) as the most frequent visitors, respectively. Hunters were asked to complete a survey answering questions including ammunition choice, weapon used, and number of shots taken. Visitation by Golden Eagles to carcasses was compared to hunter survey results and showed a potential for Golden Eagles to be exposed to lead. While this potential exists, hunter survey results showed that about 20-30% of hunters used non-lead ammunition. These results will inform management strategies centered around voluntary participation including hunter education related to non-lead ammunition options or disposition of carcasses in the field.

G40

Burrowing Owl monitoring, conservation research, and translocation in San Diego County, California

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Successful management of Western Burrowing Owls (BUOW, *Athene cunicularia hypugaea*) and their grassland habitat in San Diego County depends on a thorough understanding of their population dynamics. Since 2013, we have monitored up to 44 breeding burrows per year, and captured and banded over 800 BUOW, providing valuable information regarding survivorship and productivity. Apparent survival of both adults and juveniles is highly variable across years, which may affect long-term population stability in the region. Through our monitoring and research efforts, we continue to gain a better understanding of local factors that may influence productivity and survival, using a scientific framework for informing wildlife management decisions in the region. Local conservation management goals include increasing the number of breeding sub-populations to guard against extirpation of BUOW from the county. Through a systematic and collaborative effort, we identified two sites suitable for expanding the BUOW population. A population viability analysis utilizing three years of local demographic data predicted positive population growth from a small initial translocated population. Site preparation techniques included vegetation management, targeted enhancement of the California Ground Squirrel (*Otospermophilus beecheyi*) population, and retrofitting/installation of artificial burrows. In 2018, we began translocating BUOW using a soft-release technique. Over successive breeding seasons, we have documented reproduction and retention of translocated owls, recruitment of their offspring, and recruitment of non-translocated owls. Here, we detail our methods and findings, and discuss leveraging our collaborative efforts to achieve conservation and management goals with limited resources.

G41

Sharing is caring: The role of sociality in foraging efficiency of obligate scavengers

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Foraging behavior has been widely discussed in the scientific literature, with most of the focus being on optimal foraging theory, handling time, diet composition, and energetic intake. However, the energy budget required to move between foraging patches remains understudied. For obligate scavengers, this energy budget is crucial as they rely on unpredictable and ephemeral food patches in the landscape. Furthermore, many scavenger species form social groups where sharing information has been suggested as a mechanism for less experienced individuals to access food sources. To test the importance of social information for efficient food finding, we use GPS tracking data to calculate the relative encounter rates among individuals as a proxy information-sharing in six range-resident vulture species, including the Eurasian Griffon Vulture (*Gyps fulvus*), California Condor (*Gymnogyps californianus*) and Andean Condor (*Vultur gryphus*). We then use behavioral classification models to identify periods of search behavior for foraging areas. Lastly, we pair empirical equations from the literature with continuous-time stochastic process models to the tracking data to estimate individual energy expenditure while searching. These metrics allow us to compare energy budgets between different species and between individuals of the same population to test whether sociality (measured as encounter rates) reduces the amount of time allocated towards search behavior and the energy expenditure associated with these searches. Collectively, this work serves as a broad-scale assessment of the energetic value of social information in scavenging vultures.

G42

Wintering survival of American Kestrels in central Illinois, USA

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American Kestrels (*Falco sparverius*), the most abundant falcon in North America, have a population trend that is declining or uncertain throughout most of the species' range. In the winter months, both migratory and resident kestrels are present in central Illinois. However, few studies on the winter ecology of American Kestrels exist. Our project took two seasons of trapping, marking, and monitoring of American Kestrels in Sangamon County, Illinois. Twenty-five kestrels were captured and marked in January 2022 while an additional 25 individuals were captured and marked in January 2023. We captured kestrels primarily along roadsides using a bal-chatri trap. They were marked with nontoxic fabric dye on their breast feathers, as well as two color bands on one leg, in order to distinguish individuals. All marked birds were searched and re-sighted once a week through March in both seasons. We estimated weekly apparent survival of marked individuals that overwintered in the area based on season and sex using Cormack-Jolly-Seber (CJS) model. The results showed that the probability of resighting these birds decreased as time passed while the apparent survival remained constant (0.97) in 2022. On the other hand, in 2023, the apparent survival fluctuated but still remained high (0.87-1.0) while the probability of resighting remained constant. The percentage of birds banded in 2022 that were resighted in 2023 was 16%. Within the season, wintering survival of American Kestrels in our study was high; however, their fate was unclear from one winter to the next.

G43

Unveiling an anomaly: non-direct migration of a male American Kestrel (E/78) and its implications for understanding the annual cycle

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The American Kestrel (*Falco sparverius*) is abundant in North America, though populations have declined by >50% since the 1960s. The principal cause of decline is unknown, with suspected links to the understudied winter and migratory periods. To fill knowledge gaps of the annual cycle, we have deployed novel GPS/VHF trackers on wintering birds in north Texas. Unfortunately, technological problems have limited our acquisition of movement data. Here, we report on one male kestrel (auxiliary band= E/78), featured on the cover of Audubon Magazine, that was trapped and received a tracker in Denton County, Texas on 11 Dec 2022. Scott Kimball detected E/78 near his nest site while monitoring a breeding population of kestrels in northeastern Kansas. We successfully recaptured E/78 using a mechanical owl and mist nets, and secured data on his movements (46 locations) over a 6-month period. E/78 initiated his spring migration from Celina, Texas on 14 Mar 2023. Over the ensuing 12-day period, this male traveled 98 km/day to his breeding location in Willow Springs, Kansas. But his path was not a conventional straight-line movement. E/78 meandered between northern Oklahoma and eastern Kansas and made stopovers at three sites over the course of nine days. He travelled a total of 1,183 km, but the straight-line distance between his wintering and breeding location was a mere 629 km. Our data from E/78 seem to show a series of exploratory movements once arriving at an appropriate breeding latitude in search of a breeding territory and mate.

G44

Pitfalls arising from site selection bias in population monitoring defy simple heuristics

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Site selection bias can occur when researchers monitor animals at sites of great abundance or occupancy. The prevailing heuristic is that ecologists should never select sites using these criteria. There is concern that common monitoring schemes including surveys at colonies, migratory bottlenecks and artificial breeding sites intentionally monitor sites of great abundance. Whether routine monitoring schemes succumb to site selection bias is unexamined. We describe three previously documented site selection methods that could result in biased inference about population trends including: (1) regression to the mean, (2) preferential sampling, and (3) the missing zero effect. We simulate dynamics of long-lived vertebrate populations such as raptors to test these potential pitfalls. Simulations demonstrated that bias from regression to the mean is avoided when researchers monitor sites that are truly of great average abundance. Preferential sampling can cause a delay in detection of a decline because monitored sites are preferred by focal species and should be the first to be occupied and last to be abandoned. The missing zero effect can cause a perceived decline in stable populations because sites were chosen when initially occupied and can only be abandoned. Regression to the mean occurred during specific circumstances that do not seem biologically plausible for some study systems (e.g. colony surveys). It is therefore impractical to apply a single simple heuristic such as 'never monitor animals at sites of great abundance' across organisms of varying life histories.

G45

Changes in habitat and Golden Eagle territory occupancy in the Morley Nelson Snake River Birds of Prey National Conservation Area from 1985-2022

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Rapid loss of native shrubs and expansion of human land use and invasive annuals like cheatgrass (*Bromus tectorum*) have extensively altered the landscape within and around the Morley Nelson Snake River Birds of Prey National Conservation Area. Drastic change in vegetation can have bottom-up effects on the ecosystem dynamics of the area including the availability of prey species that rely on shrub-steppe habitat like black-tailed jackrabbits (*Lepus californicus*), the preferred prey of Golden Eagles (*Aquila chrysaetos*). The variation in land cover composition within territories may impact the availability of prey and thus the likelihood of occupancy. We used dynamic occupancy models that account for imperfect detection to investigate the associations between habitat variables, such as shrubs, annual herbaceous, agricultural cover and eagle territory occupancy from 1985-2022. Preliminary results reveal a decline in the likelihood of eagle occupancy over time, and that once historical territories become vacant, they tend to remain vacant with no new eagles recruiting into these territories. Results from this study will allow us to better understand the potential drivers of declining territory occupancy as well as predict population persistence and adaptability to shifting landscapes.

G46

Drones save time and effort: assessing the effectiveness of commercial drones for monitoring Bonelli's Eagles and Golden Eagles during the breeding season

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The popularization of Unmanned Aerial Vehicles (UAVs), commonly referred to as "drones", has revolutionized scientific research. Here, we summarize the key findings from employing a commercial drone to monitor the breeding performance of the Bonelli's Eagle (*Aquila fasciata*) and the Golden Eagle (*Aquila chrysaetos*) in Spain. The drone was operated at an average distance of 500 m from the nest, and the mean flight duration amounted to 6.7±4.4 minutes (range=1-27 min). In general, Bonelli's Eagles exhibited a higher propensity to flush the nest before the drone initiated flight. Interestingly, both species demonstrated longer nest occupancy prior to fleeing during the incubation stage, in contrast to the chick-rearing stage. Overall, Bonelli's Eagles displayed greater sensitivity to the presence of the drone, resulting in more frequent and earlier nest departures compared to Golden Eagles. Our analysis revealed no discernible variation in response type (i.e. pre-flight departure, post-flight departure, escape, warning calls) based on nest visibility to the operator, operator-nest distance, or flight duration. Response time (i.e. time to return to the nest) was shorter when the operator-nest distance was greater and during the incubation stage. In summary, the utilization of drones for monitoring purposes yields substantial time and effort savings of over 95% compared to traditional observation methods conducted from a distance. However, it is crucial to note the potential risk of eagle attacks, thus necessitating the use of drones exclusively within the framework of scientific research projects, operated for brief flight durations and by experienced personnel.

G47

Results of long-term monitoring of Ferruginous Hawks across their breeding range in Nevada

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Ferruginous Hawks (*Buteo regalis*) are considered a sensitive species in Nevada, yet little supporting data has been available until recent years. They breed across central and northern portions of the state; primarily nesting in trees within the pinyon-juniper woodland/sagebrush ecotone across central and northeast Nevada, and on rocky substrate within desert scrub and sagebrush habitat in northwest Nevada. We report on three overlapping survey efforts spanning 1999-2023 with primary goals being: a) assess site persistence in previously known territories (N=39 territories), b) track territory use over time (N=72), and c) determine local territory density and monitor breeding effort (N=41). Survey and monitoring effort varied from 1–25 years per territory (mean=5.5 years). Territories in central and northeast Nevada maintained high site fidelity, with 83% of previously known territories currently occupied after an average of 17 years since their initial discovery (range=4-42 years from previous visit). Territories in northwest Nevada had far lower annual occupancy (28.0% across years; 576 territory survey years; primarily rock/ground nesters) than territories elsewhere in the state (82.5% across years; 194 territory survey years; primarily juniper nesters).

Additionally, 16 of 72 territories in northwest Nevada were considered abandoned (≥8 years of monitoring without evidence of occupancy), and 10 more territories with fewer monitoring years were also likely abandoned (≥36% territory loss). Breeding success was 56.3% in territories in central and northeast Nevada from 2017-2022, with wide variation between years and sites.

G48

Habitat selection and flight altitude of Black Vultures influences collision risk with aircraft

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Black Vultures (*Coragyps atratus*) represent a strike risk to aircraft when they occupy flight paths of aircraft approaching and departing airports. Collision risks can be exacerbated where military aircraft fly missions at low altitudes beyond the airport terminal area. To assess collision risks between Black Vultures and military aircraft, we attached GPS transmitters to vultures to identify topographic and land cover features that influence both habitat selection and flight altitude above ground level (AGL) in the vicinity of the Eastern West Virginia Regional Airport, where the 167th Airlift Wing of the WV Air National Guard (WV ANG) is based. We identified >1,200,00 vulture locations (>680,000 during flight) from 10 vultures captured near the airport. When compared to random locations (>6,800,000), vultures showed preferences for areas with lower elevation and steeper slopes that were closer to potential food sources of primary and secondary roads and solid waste facilities. Flight AGL of vultures increased with increasing slope and increasing distance to primary roads but was lower over bare ground than other land cover types. There may be potential to reduce vulture strikes by directing low-altitude military flights (150-600 m AGL) to areas where vulture flight (95% CI of 50-200 m) is least likely to occur or where they are most likely to fly at low AGL (e.g. areas far from solid waste facilities or primary roads, areas where % slope is lowest). Managing collision risk is best done by understanding the ecological role that habitat characteristics play for Black Vultures.

G49

Evaluation of mitigation translocation as a management tool to reduce conflicts between humans and American Kestrels

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Raptor-aircraft collisions (bird strikes) pose a serious safety risk to civil aircraft. Even smaller raptors, such as American Kestrels (*Falco sparverius*), can be problematic within airport environments. Given widespread declines in kestrel populations, public interest, logistical and financial constraints, and other factors, managing this species at airports presents some unique challenges. I conducted a study to determine which biological (e.g. age and sex of the bird) and logistical factors (e.g. month, translocation distance, and number of translocations for each bird) might influence the return of American Kestrels live-captured and translocated from 42 civil airports and military airbases within the contiguous USA during 2016-202. American Kestrels were live-captured, banded, and translocated various distances from the airfields which were then monitored for returning kestrels. The number of times an individual kestrel was translocated was the only factor that influenced return rate. I found the odds of kestrel return increased 11.31 (95% CI=5.22–24.51) times for each subsequent translocation event involving the same bird. Management programs that use release sites 15 km from the airfield and undertake only one translocation event for an individual kestrel would increase program efficacy and decrease implementation costs. There is no scientific information available regarding the efficacy of American Kestrel management programs for reducing kestrel presence on airfields. This study represents an important scientific foundation for informing such management decisions.

G50

Owls and airports: a perilous match on the tarmac

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Among the unnatural danger's birds face in human-altered landscapes are airports and collisions with aircraft. Birds of prey are often attracted to airports where bird strikes are usually fatal for the birds and are a significant threat to flight safety. The Snowy Owl (*Bubo scandiacus*) is known for its nomadism, exhibiting unpredictable and highly variable movements during the nonbreeding season, including being a common visitor to airports which have high small-mammal populations and mimic flat, open habitats used naturally by owls. To aid in active management of owls at airports, we

assessed relocation data of GPS/GSM-tagged Snowy Owls to help design best practices for future relocation efforts. Owls that returned to the airport after relocation frequently crisscrossed and perched near runways where they were at risk of strikes. Immature males and adult females were more likely to return than the other sex and age classes, and returns were less likely to occur as the distance between the release site and the airport increased. Owls relocated in habitats with a greater composition of wetlands and croplands were also less likely to return. Further research will examine additional factors influencing return rates including movement patterns post-relocation and crop-specific land cover at release sites.

G51

Translocation of non-adult Bald Eagles in the Chesapeake Bay region has limited management implications for bird aircraft strike hazard

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Bald Eagle (*Haliaeetus leucocephalus*) population size has dramatically increased over the last two decades. Correspondingly, bird aircraft strike hazard (BASH) events between eagles and military aircraft have also increased. Additionally, because they are resistant to hazing on airfields and because of their additional protection under the Bald and Golden Eagle Protection Act, Bald Eagles are a challenge to manage on airfields. To address these issues, we investigated the response of non-adult Bald Eagles to translocation from the Chesapeake Bay area near Joint Base Langley-Eustis. From 2021-2022, we translocated eight bald eagles tagged with GPS telemetry. Eagles were translocated from the Coastal Plain to the Piedmont, approximately 175 km from their capture locations. Preliminary results indicate that all eagles returned to within 10 km of their capture site. The time to return ranged from 25-467 days, with a median return time of 375 days. Seven of the eight (88%) birds stayed away for >269 days. These data suggest that translocation of eagles may be most effective for short-term, rather than for long-term, management.

G52

Quantifying Golden Eagle-vehicle strike risk and mitigation in the western USA

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Golden Eagles (*Aquila chrysaetos*) in western USA are experiencing unsustainable levels of anthropogenic mortality ("take") from electrocution, collisions, etc. Eagle-vehicle strikes (EVS) occur most commonly in winter when live prey is less available and eagles scavenge on roadkill. We studied the EVS issue at eagle and roadkill hotspots in Oregon, Utah, and Wyoming in three phases. During phase I, we collected data on baseline (unmanipulated) conditions and found that moving roadkill 12 m increased eagle use and decreased flushing four-fold, relative to the road edge. During Phase II, we tracked eagle carcass persistence intensively and moved a subset of mammal roadkill "eagle safe" distances. Overall, 86% of dead eagles disappeared within seven days of discovery due to legal and illegal collection. During the first two phases, we collected 6.15 million photos at roadkill using motion-sensitive cameras, including 7,249 eagle-vehicle interactions, and found 65 dead Golden Eagles and 14 Bald Eagles (*Haliaeetus leucocephalus*). Camera data was used to improve model estimates of the number of eagles that can be saved each year via targeted roadkill management in Wyoming. During Phase III, we demonstrated the feasibility of weekly roadkill management in central Utah. Overall, we found that roadkill represents a critical, but risky winter food source for Golden Eagles. That risk can be drastically reduced with regular patrols of hotspots, proper roadkill management, and other roadkill reduction measures. We are working with wind industry and the U.S. Fish and Wildlife Service to realize roadkill management as an offset in eagle take permits.

G53

Are raptor vehicle strikes cause for concern? A review of data from western Wyoming

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Vehicle collisions are a major and increasing source of wildlife mortality worldwide. Roadkill data are often biased towards mammalian big-game species and lack a standardized reporting system. Nonetheless, in the United States, vehicle collisions are a substantial cause of avian mortality. During a study from 2019-2021 focused on eagle-vehicle strikes in western Wyoming, we also documented 11 species of 186 non-

eagle raptor carcasses along roadways during standardized right-of-way carcass surveys and fall/winter road surveys. The top five documented species were Great Horned Owls (*Bubo virginianus; N=85),* Short-eared Owls *(Asio flammeus; N=33),* Red-tailed Hawks *(Buteo jamaicensis; N=21),* Rough-legged Hawks *(Buteo lagopus; N=16),* and Swainson's Hawks *(Buteo swainsoni; N=12).* These numbers exclude additional raptors found outside of survey protocols. Here we examine the distributions and patterns of non-eagle raptor mortality, conservation implications, and the needs for future research.

G54

High rates of exposure to anticoagulant rodenticides in urban raptors in western Washington state

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Anticoagulant rodenticides (ARs), the main class of pesticide used worldwide for rodent control, also poison non-target species. In all states in the USA that have tested for secondary AR exposure in non-target wildlife, widespread contamination has been found, particularly by second-generation ARs (SGARs), which are more lethal and persistent. Raptors are a population of particular concern. They provide an ecological service by preying heavily on rodents in human-dominated areas where ARs are used. Effects of AR poisoning are often not obvious without necropsy and toxicology testing. In a four-year study (2018-2022), we opportunistically sampled 272 primarily urban raptors (10 species of hawks, owls, eagles, and falcons) that had died or were euthanized at PAWS Wildlife Center in western Washington; 50 of these raptors were also sampled for the neurotoxin bromethalin. Toxicology analysis was done at Texas A&M Veterinary Medical Diagnostic Laboratory. Most raptors tested positive (ppb) for at least one SGAR, many were positive for two to four different SGARs and ARs, and one of these was also positive for bromethalin. This study documents the widespread prevalence of ARs in raptors in western Washington. Results will be compared among species and to similar studies in other regions.

G55

Anticoagulant rodenticide toxicity in terrestrial raptors: tools to estimate the impact on populations in North America and beyond

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Anticoagulant rodenticides (ARs), specifically second generation compounds (SGARs), have caused widespread contamination of terrestrial birds of prey. Diagnosis of AR poisoning proceeds mainly on evidence of hemorrhage and detection of residues in liver. Previous attempts to determine guidelines for hepatic concentrations indicative of AR toxicosis have produced markedly different values. Many factors confound assessments: exposure dose, timing and frequency of exposure, intra- and inter-taxon specific differences in sensitivity related to body condition, incidental trauma, nutritional state, and other variables. Simple summation (∑SGARs) of individual compounds also may be influenced by variability in the potency and kinetics of individual AR compounds. Thus, there has been a need for better taxonomic, and compound specific AR toxicity criteria in order to improve interpretation of liver residue data and assess toxicity implications for predatory birds, ideally at the population level. To try to improve guideline numbers, we compiled a database of hepatic SGAR residues and post-mortem evaluations from 951 terrestrial raptor carcasses collected from Canada and the USA, 1989-2021, representing 26 species of mainly owls and hawks. Generalized linear mixed-effects models (GLMMs) were developed and used to produce specific probability curves of the toxicity of ∑SGARs at the taxonomic level of the family, and separately for the three SGARs registered for use in North America, brodifacoum, bromadialone and difethialone. We will present threshold concentrations for ∑SGAR and individual compound toxicity based on diagnosis of coagulopathy.

G56

Importance of DoD-conserved lands to Golden Eagle populations: monitoring of Golden Eagles occupying an active military test range in southern New Mexico

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Golden Eagles (*Aquila chrysaetos*) are increasingly becoming a focus for conservation with respect to anthropogenic threats. Given the increase of human caused mortality in recent years, the U.S. Fish and Wildlife Service has a growing concern for this species, listing the eagle as a Bird of Conservation Concern in the Southwest and Mountain-Prairie Regions. Furthermore, the Department of Defense (DoD) Partners in Flight program considers the Golden Eagle a mission-sensitive priority bird species on DoD lands. At the request of the U.S. Army's White Sands Missile

Range (WSMR), The Peregrine Fund initiated an effort in 2012 to determine the distribution of eagles on WSMR, increase our understanding of eagles in the Southwest, and better inform management actions for conservation while maintaining the military mission. This effort has involved the implementation of nest inventory flights, occupancy surveys, reproductive assessments, spotlight prey surveys, monitoring movements of a pair occupying an upcoming active test site, investigations into scavenger use of hunter killed oryx (*Oryx gazella*) to assess potential lead burden on raptors, and a collaborative effort to gather naturally shed feathers to test for potential sublethal lead exposure and subsequent stress hormone response. Efforts have documented 279 nests making up 31 breeding territories. Territory occupancy is generally high, averaging 86%, but reported 100% occupancy for the first time in 2023. Since the Golden Eagle population in this area of New Mexico is not well known, results from this work will broaden eagle conservation in the Southwest and supplement other Chihuahuan Desert studies.

G57

Rise and demise of tropical island raptors: the post hurricane occupancy shift of the endangered and endemic Puerto Rican Broad-winged Hawk and generalist Red-tailed Hawk

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The Puerto Rican Broad-winged Hawk (*Buteo platypterus brunnescens*, hereafter BWHA) is an endangered endemic woodland raptor whose populations are limited to three disjunct forest tracts of Puerto Rico. With a limited and isolated distribution and dwindling population, the BWHA is highly susceptible to catastrophic events. In 2021, we conducted a rapid assessment of the BWHA status following Category 4 Hurricane María, that caused substantial habitat loss in the populations' breeding stronghold. We found an 82% (132 to 24) decrease in detections of BWHA and an 82% (12 to 67) increase in detections of Red-tailed Hawks (*B. jamaicensis*, hereafter RTHA) when compared to previous studies with the same sample effort conducted in 2016. In 2022, expanded survey efforts assessed the island-wide distribution of the species and determine occupancy across suitable habitat. We conducted a single-species occupancy model to estimate the probability of true presence of both hawks (probability of occupancy, PSI) and related detection probability (P) to account for imperfect detection (false negatives). We found that in 106 survey points, BWHAs were recorded at 23 with a PSI=0.25±0.06 and a P=0.37±0.07, in contrast, RTHAs were observed at all 106 points with a PSI=0.99±0.001, P=0.96±0.012. Our findings could suggest a shift in species occurrence following habitat disturbance caused by Hurricane Maria, which may have benefited the generalist behavior of the RTHAs and negatively impacted the population of the BWHA, potentially compromising the recovery of this endangered and endemic island raptor.

G58

Owl species composition and general abundance at Valles Caldera National Preserve, New Mexico

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Although multiple owl species occur in Valles Caldera National Preserve (VCNP), knowledge about this community is limited. Our goals included increasing knowledge regarding species presence, spatial distribution, general abundance, and annual variation in abundance and distribution. Since 2020, we have conducted nocturnal broadcast surveys at 40 call points for Mexican Spotted Owl (MSOW; *Strix occidentalis lucida*), Flammulated Owl (*Psiloscops flammeolus*), Northern Pygmy-Owl (*Glaucidium californicum*), Northern Saw-whet Owl (*Aegolius acadicus*), Western Screech-Owl (*Megascops kennicottii*), and Long-eared Owl (*Asio otus*). Great Horned Owl (*Bubo virginianus*) is documented opportunistically to avoid violating federal MSOW survey protocol. Barn Owl (*Tyto alba*) surveys were initiated in 2021. MSOW surveys follow federal MSOW protocol, including daytime follow-ups and monitoring. Surveys for other species occur on different nights, based on the U.S. Forest Service's Multiple Species Inventory and Monitoring nocturnal broadcast protocol. During the first three years of surveys, we documented 804 detections among eight species, including the first confirmed MSOW and Barn Owl detections in VCNP. We documented an average of 4.25 species/point, indicating a large species spatial overlap. The most common species were Flammulated Owl (38 points, 0.42 detections/survey among all surveys), Great Horned Owl (37 points, 0.22 detections/survey), Northern Saw-whet Owl (33 points, 0.12 detections/survey), and Long-eared Owl (28 points, 0.10 detections/survey). Flammulated Owl detection rates increased annually, while Great Horned Owl decreased annually. Northern Saw-whet Owl detection rates were highest in 2020, while Long-eared Owl and Northern Pygmy-Owl were highest in 2021 and lowest in 2022.

G59

Design of the urban and industrial garden based on Ferruginous Pygmy-Owl behavior in the Costa Rican Central Valley

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Hotel Robledal, Alajuela, Costa Rica. Birding Central Valley, Alajuela, Costa Rica.

In northwestern Costa Rica, some bird species use tree cavities during the nesting period. This reproduction stage coincides with the dry season, which begins in November and extends until April. Between 2012-2023, there were reports of fires of pastures and abandoned farms, which likely affected the reproductive cycle and were a hazard for nesting sites of Ferruginous-Pygmy Owls (*Glaucidium brasilianum*). During this time 15 artificial cavities of different dimensions were placed within a 5 km radius from the gardens of Hotel Robledal, three of which were nest boxes occupied by Ferruginous-Pygmy Owls (*Glaucidium brasilianum*). We monitored nests and identified prey, and applied sustainable practices for the general management of our grounds. Over 12 breading seasons we used nest observations to understand the importance of a management plan, not only to support cavity nesting birds but also the management of urban gardens. The urban and industrial garden represents an excellent opportunity for nesting Ferruginous Pygmy-Owls and other owl speciesthat require certain conditions to carry out their reproductive cycle.

G60

Evaluating convolutional neural network models detection of Northern Spotted Owl vocalizations

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Automated recording units hold great promise for recording the diversity of nature. However, these units collect vast amounts of data that require processing prior to review for possible target species. Ideally, software will produce a target set of species identifications that minimizes false positives and false negatives. We evaluated three iterations of a Northern Spotted Owl (*Strix occidentalis caurina*, NSO) Convolutional Neural Network model with data that were not used in training or validation stages of development. From March 2014-February 2019, we collected audio recordings at five previously known NSO nest locations in the Oregon Coast Range, USA. From these recordings, we randomly selected 1,000, 5 min clips, with each clip being partitioned into 25, 12 s non-overlapping segments. We assigned each clip the maximum NSO probability of detection from the 25 segments for each of the three model iterations. A third party listened to all clips and recorded the start and stop time of all owl calls. We calculated metrics that are considered best practices in signal processing. Area under the receiver operating area curves were 0.81, 0.88, and 0.87 for the first, second, and third versions, respectively, suggesting that the second and third versions performed better than the first version. The other metrics demonstrated similar patterns of performance. Our results indicated that the second and third model iterations were similar and both were superior to the first model. Using these models for real-time recording and data processing will require a better understanding of how false detections arise.

G61

Towards a macro-theoretical framework to analyze the biology of raptors

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Despite the increasing relevance and number of studies in different segments of the biology of raptors, a more comprehensive assessment of the theoretical framework of their biology still needs to be completed. Considering a single conceptual element of the given segment in isolation only provides an incomplete understanding or partial knowledge of how the biological system works; thus, understanding how these segments interact with one another is critical to assessing the biology of raptors. In addition, some concepts still need to be more accurately defined, given that several of these are often misapplied, thereby unintentionally altering ecological conclusions of the natural history traits. This presentation intends to fill this gap by proposing a theoretical framework that is under development by categorizing different segments of the biology of raptors to assist researchers whether they are using the concepts appropriately and whether the predictions of the hypotheses proposed are well-established. Therefore, this presentation aims to: (1) describe the linkages among the different segments of the biology of raptors; (2) highlight the importance of correctly assigning individuals age classes since it is a critical element to understanding the overall biology of raptors; (3) argue that most raptors species exhibit continuous color variation and only a few species exhibit discrete color variation; (4) discuss that the predictions of several hypotheses (e.g., winter irruption and differential migration by age) that involve age classes as a variable must be integrated with delayed plumage maturation since there are raptors that exhibit more than two age classes.

G62

A comprehensive whole-genome phylogeny for the Red-tailed Hawk

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The Red-tailed Hawk (*Buteo jamaicensis*) is a common, widespread, and highly diverse species with the potential to serve as a model for understanding broad patterns and processes in the ecology and evolution of raptors. The species includes 16 described subspecies that inhabit most of North and Central America, the Caribbean, and a few isolated islands off the coast of Mexico. Despite much debate regarding the taxonomic status of the insular taxa, as well as mainland populations that are highly divergent in appearance, there has been little work to understand the relationships between such distinct populations. To resolve these relationships and provide a foundation for understanding the evolutionary history and development of diversity in this species, we sequenced whole genomes of multiple individuals of each of the described taxa from a combination of blood samples collected in the field and museum specimens. We also include individuals from the allopatric sister taxon Rufous-tailed Hawk (*B. ventralis*) of southern South America to assess its relationship to *B. jamaicensis*, and to provide context for assessing relationships of allopatric populations in the Pacific and Caribbean, as well as those highly divergent in appearance. We discuss the implications of our results and how a comprehensive phylogeny can serve as a foundation for further investigations into the ecology and evolution of this emblematic raptor.

G63

Using ultraconserved elements and legacy markers to address the non-monophyly of the genus Accipiter (Accipitriformes: Accipitridae)

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With approximately 50 species the hawk genus *Accipiter* is one of the most speciose groups in all of Aves. Although the majority of taxa have similar behavior, plumage, and habitat preferences molecular phylogenies have repeatedly shown that this group is not monophyletic due to the inclusion of the harriers (*Circus*) and potentially other genera. Here, we combine a new large dataset obtained from assembling ultraconserved elements (UCEs) from whole genome sequencing with publicly available legacy markers (i.e. a suite of commonly sequenced mitochondrial and nuclear genes) to infer a well-supported, time-calibrated phylogeny. Our densely-sampled phylogeny confirms the non-monophyly of *Accipiter* and provides a sufficient basis to revise the genus-level taxonomy for this group. To create genera that represent monophyletic lineages we recommend splitting *Accipiter* into four groups while retaining *Circus*, *Megatriorchis*, and *Erythrotriorchis* as distinct genera.

G64

Safe and legal access to telecom equipment hosting nesting birds: bridging the gap between service-reliability and nest success

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Our modern world demands wireless connectivity for public health and safety services such as E911, support for navigation, telehealth and remote learning. Misinterpretation of migratory bird protections, and slow awareness of federal regulatory changes are the core drivers of inaction or misaction that disrupts service-reliability and nesting birds. Fear of violations can delay critical access to equipment at sites when birds and nests are present. Likewise, a lack of awareness or understanding of recent Migratory Bird Treaty Act regulatory changes may misinform actions that result in harm to nesting birds supported on telecom equipment. Cell Tower Osprey Management (CTOM) promotes migratory bird education and awareness. We have collected years of data at sites where nesting birds were monitored and work was conducted. These data have allowed us to systematically develop processes for providing real-time support to crews in the field, thereby bridging the gap between service-reliability needs and nest success. CTOM will review case studies of data collected for our ongoing study. The goal of our study is to determine the potential relationship between nest success and work disturbance. We suspect nesting birds are more capable of tolerating disturbance under certain conditions than is currently understood, particularly when nesting on man-made structures in an environment where they are likely habituated to anthropogenic activity. We will share metrics for birds commonly found nesting on telecom structures nationally, including nesting transitions and developing trends, and discuss what these trends may mean for managing safe and legal access in the future.

G65

Saving raptors in Mongolia: country-scale retrofitting of insulation to reduce avian electrocution at power lines

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The delivery of electricity to widely dispersed communities across the open steppe grasslands of Mongolia depends on medium-voltage (10-35 kV) distribution lines. Previously utilizing wooden supports, upgraded and new distribution lines are now designed to be cheaper, using steel-reinforced concrete poles with galvanized steel crossarms that can carry an electrical charge to the ground. Surveys and monitoring of these dangerous power lines revealed that raptor electrocution rates were high, especially in areas with abundant prey, and widespread across steppe habitats. With around 3,500 km of hazardous lines in the Mongolian steppe zone, it was estimated around 18,000 raptors, including 4,000 Saker Falcons (*Falco cherrug*), were electrocuted each year. Experimental trials indicated that retrofitting insulation could significantly reduce electrocution risk. We designed and manufactured our own equipment to meet our six criteria of being (i) effective, (ii) durable, (iii) failsafe with (iv) no impact on power supply, (v) simple to install and (vi) low cost. Over the period 2019-2022, we retrofitted insulation to 34,425 poles at 67 power lines covering a linear distance of 3,450 km, at an equipment cost of less than USD $40 per pole. Comparison of carcass counts under poles before and after retrofitting indicated a significant reduction in electrocution events. We hope to use this project as an exemplar to focus attention and attract funding to address the issue of raptor electrocution at a global scale.

G66

A golden opportunity: investigating the effectiveness of Golden Eagle relocation as a management strategy to mitigate sheep depredation in Wyoming

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Eagle depredation of sheep has been documented as an increasing human-wildlife conflict, potentially due to the modern anthropomorphic and environmental challenges eagles face. Relocation is a proposed tool to mitigate this wildlife conflict and decrease eagle persecution. Our objective was to investigate if relocation of Golden Eagles (*Aquila chrysaetos*) could be implemented for management of sheep depredation and understand which habitat variables relocated eagles are selecting. We predicted that age and relocation distance would influence the return rate of individuals, and that habitat selection would reflect similar preferences between relocated and non-relocated eagles. Habitat surveys were conducted to find relocation sites that were safe from human development and had suitable prey numbers. We trapped 12 eagles and fitted them with cellular GPS transmitters to provide insight into their movement patterns and habitat preferences post release. Eagles were relocated at distance intervals, ranging from 100-400 miles. We modeled resource selection using linear mixed effect models and auto correlated kernel density estimates to determine habitat preference between the relocation and stopover sites using multiple covariates. Eighty percent of relocation events resulted in the absence of the eagles for at least three weeks and were deemed successful by landowner's standards. Adult eagles returned to the capture site more quickly than younger individuals ($P<0.05$), whereas relocation distance and season did not influence the return time ($P>0.05$). Our return analysis showed little evidence that eagle translocation would be an effective management strategy long-term, and would have various logistical and biological challenges if implemented statewide.

G67

Dead birds flying: can North American rehabilitated raptors released into the wild mitigate anthropogenic mortality?

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The expanding human footprint is increasingly impacting avifauna. Raptors are particularly susceptible to anthropogenic caused mortality. Federal laws encourage industry sectors to offset anthropogenic mortality. Several options to mitigate these losses have been proposed, including raptor rehabilitation. However, its role as a conservation tool is often received with skepticism. Currently no demographic analyses exist using post-release data from rehabilitated raptors to evaluate its effectiveness at continental scales. Our objectives were to estimate annual survival of rehabilitated and wild raptors, and then use those estimates into demographic models to assess potential effects at individual and population levels. We hypothesized that rehabilitated raptors would survive similarly to their wild counterparts after an acclimation period. We used U.S. Geological Survey Bird Banding Lab band-recovery data (1974-2018) from 20 raptor species for

modeling survival of rehabilitated (N=125,740) compared to wild birds (N=1,913,352). We acquired admissions (N=69,707) and release (N=25,740) data (2012-2021) from 24 rehabilitation centers across the conterminous USA. Results from 17 species with adequate recovery data indicated that five species ≠ wild survival, three species had uncertain estimates, and nine species ≈ wild survival by years 2 and 3 post-release. The general pattern resulting from our demographic models was for K-selected species to yield larger benefits from rehabilitated supplementation. Combined these results provide evidence that rehabilitation may serve as mitigation tool to offset incidental take. We discuss potential calculations for estimating mitigation ratios and broader implications for this conservation challenge.

G68

Does the release of Bonelli's Eagle from captive breeding nucleus contribute to population rehabilitation?

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During the late 1960s, the Bonelli's Eagle (*Aquila fasciata*) population in Israel was brought to the brink of extinction, due to a combination of factors. A rehabilitation program started in 2000 including the release of eaglets from a captive breeding nucleus, producing two to seven eaglets yearly. In recent years there is an apparent increase in the number of Bonelli's Eagle pairs breeding in the wild, including the reoccupation of territories that were abandoned for many years. Yet, there is little evidence for the recruitment of captive-born eagles into the wild population, and their contribution to its growth is unclear. These subjects are now being examined by a telemetry study, comparing dispersal patterns and survival rates of captive versus nature hatched eagles. The results from the first five years of study show significant differences between these two groups, with captive hatched eagles dispersing much farther away from their natal site compare to the dispersal of wild eagles. The different dispersal patterns may be the reason for the lower survival rates exhibited by the captive hatched eagles, as many of them wander to neighboring countries where they are subjected to shooting and trapping. Moreover, these birds also have a higher tendency to being electrocuted on power lines. Genetic analysis and alteration of the releasing methods are being used in order to check whether the different movement and behavior attributes of the captive-hatched eagles are linked to genetic properties or behaviorally mechanisms during their growth.

G69

Post-release survival of Golden Eagles following clinical rehabilitation from injury and disease

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Wildlife rehabilitators expend substantial resources to rehabilitate Golden Eagles (*Aquila chrysaetos*) and other raptor species with little knowledge of post-release survival. Moreover, there is interest in supporting rehabilitation and release of injured or diseased Golden Eagles as a means of offsetting fatalities of wild Golden Eagles associated with energy projects (e.g. blade-strike mortality at wind turbines). However, post-release survival probability of rehabilitated eagles may differ from that of free-ranging eagles never held in captivity for rehabilitation. To our knowledge, this question has not been rigorously addressed. Our objective is to estimate post-release survival of rehabilitated Golden Eagles monitored via satellite telemetry in western North America and compare the estimate to that of free-ranging, wild conspecifics. From May 2014 through June 2023, we monitored the post-release survival of 27 Golden Eagles that had been admitted for rehabilitation when ≥10 months old. Rehabilitation lasted 29-321 d (mean=40 d). Within 1 yr of release, 17 (63.0%) of the eagles died (fates of three of these were classified tentatively as deaths based on circumstantial evidence), seven (25.9%) survived, and three removed or dropped transmitters midway through the year. If the latter three survived ≥1 yr, 37.0% of all eagles studied survived ≥1 yr post-release, suggesting that annual survival may be less than half of that reported for wild Golden Eagles. Additionally, we documented atypical, extensive post-release movement by some of the eagles. We will present results of survival analyses to be completed after data collection ends in June 2023.

G70

Conserving the evolutionary history of birds

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In the midst of the sixth mass extinction, limited resources are forcing conservationists to prioritize which species and places will receive conservation action. Evolutionary distinctiveness measures the isolation of a species on its phylogenetic tree. Combining a species' evolutionary distinctiveness with its extinction risk creates a measure called an EDGE score. We use EDGE scores to prioritize the places and species that should be managed to conserve bird evolutionary history. We analyze all birds across species, orders, countries, and important bird areas. We further examine parrots, raptors, and seabirds in depth because these groups are especially threatened and relatively speciose. These three focal groups have greater median threatened evolutionary history than other birds, making them important for conserving bird evolutionary history. Australia, Brazil, Indonesia, Madagascar, New Zealand, and the Philippines are especially critical countries because they have the most threatened evolutionary history for endemic birds and are important for parrots, raptors, or seabirds. We further highlight that increased enforcement of international agreements for the conservation of parrots, raptors, or seabirds is needed because these agreements protect hundreds of millions of years of threatened bird evolutionary history. Decisive action is required to conserve evolutionary history of birds into the Anthropocene.

G71

Taxonomic status of Bay-winged Hawk and Harris's Hawk, with documentation of delayed plumage maturation in Bay-winged Hawk

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The two main populations of *Parabuteo unicinctus* have long been treated as subspecies of the same species: Harris's Hawk (*P. u. harrisi)* in the southern USA to Costa Rica, and Bay-winged Hawk (*P. u. unicinctus)* in South America. However, they differ considerably in their morphology, number of plumages, and behavioral ecology. Adult Harris's Hawk differs in multiple plumage characters from adult Bay-winged Hawk, and differences are even more marked in juvenile plumage. Harris's Hawk has two age-related plumages but Bay-winged Hawk shows delayed plumage maturation and has four such plumages. Harris's Hawk breeds and hunts cooperatively, whereas Bay-winged Hawk breeds only in pairs, and hunts individually. There are no valid records of Harris's Hawk in South America. We believe that the differences in adult and juvenile plumages, the number of immature plumages, and differences in breeding and hunting mean that Harris's Hawk and Bay-winged Hawk are best treated as separate species.

G72

Timing of emergence of sexual size dimorphism in American Barn Owl nestling development

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Timing of development of sexual dimorphism during avian nestling growth affects important life history characteristics including parental investment in nestlings, behavioral dynamics among nestlings within a clutch, and individual nestling's nutritional needs during the growing period. While we can tell an adult Barn Owl's sex by their plumage, it can be more difficult to age nestlings prior to growth of their body feathers growing in, limiting the scope of inference that can be made for nestlings in early developmental stages. Here, we collected weekly measurements of American Barn Owl (*Tyto furcata*) nestlings to describe growth rates and to identify the timing of emergence of sexual dimorphism in developing nestlings in a common raptorial species in the Americas. We used nonlinear regression to compare growth rates of each sex and linear discriminant analyses to identify when sexual dimorphism in the species emerges. By identifying when sexual dimorphism occurs, we may be able to use previous knowledge (e.g. facial disc eruption) to identify an individual's sex at an earlier age. Hence, the results of this analysis may help identify nestlings by sex prior to using plumage coloration. Comparisons were also made by sex between adult and near-fledge nestlings which showed that growth continued post-fledging in the hallux, culmen, wing and tail. These findings may help identify hatch year, and after hatch year individuals depending on time until full growth post-fledge.

G73

Ecomorphological adaptations of owl feet and talons

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Feet and talons are the most specialized predatory attributes of raptor morphology. As such, the hindlimb morphology of owls should reflect their dietary specialization. Owls' diet varies widely between species with only a subset of owl species preying predominantly on small mammals. We hypothesize that different owl species have varied hindlimb morphology, adapted to their main prey types, and that only dietary specialists will be distinguishable based on talon morphology (e.g. toe length, talon curvature and thickness, etc.). We used a sample of 63 specimens from 15

owl species to obtain a variety of measurements of hindlimb morphology. We then used a discriminant function analysis to investigate the degree of variation between species and diet groups in terms of their morphological measurements. Our results indicate that talon morphology is linked to prey type in the owl species studied. Insect specialists and small mammal specialists were characterized by a low talon curvature, whereas generalists presented a pronounced talon curvature. Fish specialists presented particularly thick and robust talons, and insect specialists showed lower digit strength than other owl species. These findings could help determine the diet of other owl species, particularly endangered species for which data on diet is often scarce. This study will also be very useful in future studies of the ecology of sympatric species, resource partitioning between species, or between sexes of the same species, and more generally to the evolution of owls.

G74

Raptor research and natural history museums: start of the Raptor Research and Museum Collections Committee

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Natural history museums are repositories of information, expanding from the physical outwards to a diverse set of data, including species' movement, behavior, health, and morphology. The most common types of objects considered in museums are skins, skeletons, eggs and nests, animals and parts in fluid, and tissues. In addition, museums may include archival media, photographs, videos, and sound recordings. With the advent of digitization the information from museums has become accessible globally through online repositories. This introduces new opportunities for researchers who work with birds of prey, as a vast field of data is now available for exploration and use. As museum collections can provide information across wide areas of geographic space and time, museum data can an augment occurrence and sighting data from banding and migration sites. As museums work to expand further into new types of digital data, raptor researchers can have an important role in shaping the development and growth of natural history collections. In this talk I will introduce the new RRF committee on Raptor Research and Museum Collections, the committees developing goals and focus, and how museums and raptor research have a long and important intertwined history. By presenting the types of scientific material that are available in museums, how to access this data, and the benefits of archiving your research at a museum I will introduce raptor researchers to the varied types of data in collections, and how the new committee will work to further the understanding and connections between museums and raptor research.

G75

Declining richness, abundance, and productivity of raptors nesting at the central plains experimental range

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The Central Plains Experimental Range (CPER) is an agricultural research station established in the 1930s to study effects of management strategies on grassland ecosystems while maximizing long-term cattle production. CPER occupies 63 km^2 of northeastern Colorado's semiarid shortgrass steppe, and has historically been home to nesting Swanson's Hawks (*Buteo swainsoni*), Red-tailed Hawks (*Buteo jamaicensis*), Ferruginous Hawks (*Buteo regalis*), Golden Eagles (*Aquila chrysaetos*), and Great Horned Owls (*Bubo virginianus*). From 2015 through 2023, we quantified the richness, abundance, and productivity of raptors nesting there. In 2015, we documented a high of 11 nesting attempts by four species resulting in six successful nests producing a total of 10 chicks (5 Swanson's Hawks, 1 Red-tailed Hawk, 1 Golden Eagle, and 3 Great Horned Owls). Numbers declined steadily (fit straight lines: R2 nests attempted=0.767, R2 nests successful=0.878) to a low in 2021 when only two nest attempts produced a single Swainson's Hawk chick. Numbers remained low in 2022, with 2023 data collection ongoing at the time of abstract submission. Declining numbers correlate with broad patterns in avian populations generally, and with declining numbers of grassland birds and raptors specifically. Declining numbers also correlate with increasing numbers of humans in the area as assessed via quantifying the number of structures within 5 km of CPER (fit straight lines: R2 nests attempted=0.795, R2 nests successful=0.674). Overall, declining richness, abundance, and productivity of raptors nesting at CPER correlates with a general pattern of ecosystem decay in North American grasslands.

G76

Evaluating the effects of nest management on a recovering raptor population using an integrated population model

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Evaluating population responses to management is an important component of successful conservation programs.

Models predicting population growth under different management scenarios can provide key insights into the efficacy of specific management actions in reversing population decline and in maintaining recovered populations. Bald Eagle (*Haliaeetus leucocephalus*) conservation in the United States has seen many successes over the last 50 years, yet the extent to which the Bald Eagle population has recovered in Arizona, an important population within the Southwest region, remains an area of contention. Estimates of their population trend and an evaluation of ongoing nest-level management practices are needed to inform future management actions. We developed a Bayesian integrated population model (IPM) and population viability analysis (PVA) using a 35-year dataset to assess Arizona Bald Eagle population dynamics and their underlying demographic rates under current and possible future management practices. We estimated that the population grew from 78 females in 1993 to 219 females in 2022, an average yearly increase of 3.5%. Breeding areas that had trained personnel (i.e. "nestwatchers") stationed at active nests to mitigate human disturbance had at least 6% higher reproductive output than nests without this protection. Uncertainty around population trends was high, but scenarios that continued the nestwatcher program were less likely to predict abundance declines than scenarios without nestwatchers. Here, the IPM-PVA framework provides a useful tool both for understanding current population viability and for estimating the effectiveness of past management actions to inform strategies for maintaining recovered populations.

G77

Collaborative research prioritization to evaluate potential drivers of population declines for the American Kestrel in the United States

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American Kestrel (*Falco sparverius*, hereafter kestrel) populations have been declining across most of their North American range for several decades and drivers of decline remain uncertain. Kestrel experts and natural resource managers participated in a structured decision making workshop to generate hypotheses to address potential causes of regional and national declines. Hypotheses were evaluated using a new decision analytic tool, constructed value of information (CVoI), to prioritize future monitoring and research. Participants generated 13 hypotheses related to drivers of population declines and scored each hypothesis (N=32 scorers) using expert judgment across three criteria: 1) magnitude – the amount of empirical or theoretical support in the literature, 2) relevance – whether reducing uncertainty would change management or the hypothesized effect could be detected, and 3) reducibility – the feasibility of reducing uncertainty. We calculated mean and standard errors for CVoI (magnitude*relevance) and reducibility for each hypothesis. Hypotheses scoring highest in both CVoI and reducibility (N=3) focused on effects of gamebird management, nest cavity type, and winter roost availability. The nest cavity type hypothesis had the highest value (CVoI) for reducing uncertainty, and a road mortality hypothesis was ranked as most feasible for reducing uncertainty. Hypotheses with low CVoI and reducibility (N=5) included effects of lethal take, outdoor cat populations, and benefits gained by public outreach about kestrel population declines and habitat needs. Currently, we are building regional-scale integrated population models to evaluate whether drivers of decline predicted by the prioritized hypotheses are likely to influence regional population dynamics for the kestrel.

G78

Population changes in a western raptor guild up to 18 years after wind power development in the Pacific Northwest, USA

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Impact assessment of wind power development on raptors is rarely specific to nesting populations, typically based on estimates of direct mortality, and may not address passive displacement. We evaluated long-term changes in a western guild of nesting raptors along the mid-Columbia River within 18 wind power projects. We conducted occupancy surveys in 2020 and 2021 from 1-18 years after projects were completed and determined changes in numbers and composition of nesting raptors and Common Ravens (*Corvus corax*) from pre-construction surveys. Nesting Golden Eagles (*Aquila chrysaetos*) declined by 100%, Ferruginous Hawks (*Buteo regalis*) declined by 64%, but Common Ravens increased by 1160%. There were smaller increases in nesting Swainson's Hawks (*B. swainsoni*), Red-tailed Hawks (*B. jamaicensis*) and Great-horned Owls (*Bubo virginianus*). To determine whether factors other than wind power development contributed to these changes we used multinomial models to compare composition of nests by species at four nearby reference areas monitored during the study. On project and reference sites proportions of Ferruginous Hawks declined but Common Ravens increased, suggesting there were other

factors affecting these species in addition to wind power development. Golden Eagle numbers were too low to analyze proportional changes. Long-term increases of species more adapted to nesting in altered habitats on wind power projects may have secondary effects on more sensitive species through competition and predation. We demonstrate that critical changes that some nesting populations of raptors may experience from wind power development require long-term monitoring that may not be addressed by fatality monitoring alone.

G79

Estimating American Kestrel population vital rates at a broad geographic scale

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American Kestrels (*Falco sparverius*) have been declining across most of their North American range at a steady rate of approximately -1.4% per year for several decades. Although loss of habitat is one hypothesized factor in the decline of grassland birds, the cause of the kestrel decline remains unknown despite several local studies and two broad reviews of available data. Until the cause(s) of the kestrel decline are identified, effective corrective management actions cannot be initiated. As part of a collaborative effort to clarify the drivers of kestrel population declines, we developed a continental-scale integrated population model using band-recovery data, productivity data, and Breeding Bird Survey indices from 1986-2021 to estimate survival and productivity rates across North America. There was little evidence of a trend in brood size, the probability of successful breeding, or brood sex ratio. However, first year male and female survival during the summer appeared to be declining, suggesting these vital rates could be contributing to declines in population size over time. During January-February 2023, we convened experts for a structured decision-making workshop to summarize the state of research in North America and generate alternative hypotheses for declines in kestrel population size that may vary across space and time. We are currently building regional-scale integrated population models to evaluate relative support for these alternative hypotheses across flyways to prioritize research and management intervention.

G80

Assessing population status of North American diurnal raptors using migration and winter counts

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Using migration trend data from the Raptor Population Index (N=76 counts sites) and winter CBC trend data at the state and province level, we evaluate continental and regional patterns in trends of North American diurnal raptors over the last 30 years. Long-term trends at the continental level show widespread declines in the number of American Kestrels (*Falco sparverius*; AMKE), Northern Goshawks (*Accipiter gentilis*; NOGO), and Rough-legged Hawks (*Buteo lagopus*; RLHA) counted both during migration (1999-2019) and in winter (1996-2019). Several species, including Cooper's Hawk (Accipiter cooperii), Osprey (*Pandion haliaetus*), Red-tailed Hawk (*Buteo jamaicensis*), and to a lesser extent Northern Harrier (*Circus hudsonius*) and Sharp-shinned Hawk (*Accipiter striatus*; SSHA), experienced declining migration counts but increasing winter counts over the last 30 years, indicating potential shifts in migratory behavior. Bald Eagles (*Haliaeetus leucocephalus*), Peregrine Falcons (*Falco peregrinus*), Turkey (*Cathartes aura*) and Black Vultures (*Coragyps atratus*), and Merlin (*Falco columbarius*) show increasing long-term migration and winter counts indicating growing populations at the continental scale. Recent trends (2009-2019) showed a reduced intensity in both migration and winter declines for counts of NOGO, RLHA, and AMKE compared to the long-term dataset and SSHA joined this group as species with evidence of recent declines on migration and in the winter. We also explore evidence of regional variation in the trends for some species across North American, with a few species with higher declines in the eastern part of the continent. We encourage research efforts to better understand the drivers of these declines for these species.

G81

Provisioning rates and prey composition of a declining predator, the Little Owl, in contrasting European farmlands

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The Little Owl *(Athene noctua) i*s a small and sedentary raptor associated with agricultural landscapes. Widely distributed, it is rapidly declining in Central and Western Europe. Food limitations during the breeding season may be responsible for population declines (which may reduce reproductive success); however, how prey composition and/or provision rate relate to nestling's age, weather conditions and habitat quality in agricultural landscapes remains poorly understood. To fill this knowledge gap, we studied prey composition and provisioning rates of breeding Little Owls in different European countries (Czech Republic, Netherlands, Slovakia and Germany) using nest boxes with cameras. Overall, mammals (37%) represented the highest proportion of prey biomass delivered to nestlings, followed by earthworms (28%). More specifically, mammals were the predominant prey in terms of biomass (48%) delivered during the first ten days after hatching, followed by insects (30% of biomass) which peaked during the period 11-20 days after hatching, and earthworms (44% of biomass) which were more present 20 days after hatching. GLMMs indicated that provisioning rates increased with higher temperatures but decreased under rainy and humid conditions. Owls foraging in high-quality habitats (grasslands, gardens, orchards) had an increased provisioning rate, but the effects were not significant. However, the interaction between nestling age and high-quality habitats within agricultural landscapes was highly significant. Provisioning rates decreased with nestling age, especially in territories with lower proportions of high-quality habitats. These results will be crucial to inform conservation interventions for the species.

G82

Ferruginous Hawk diet and behavior in two areas in New Mexico which differ in degree of anthropogenic alteration

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Habitat loss from human development affects native wildlife populations, especially in the Western United States where the human population is growing two-three times faster than any other part of the country. We studied diet, behavior, and productivity of Ferruginous Hawks (*Buteo regalis*), a species considered sensitive to human presence, nesting in rural and exurban grasslands in New Mexico, USA, to better understand the conservation needs of this species on the periphery of its breeding range. Hawks breeding in the exurban grassland (i.e. exurban hawks) consumed more Gunnison's prairie dogs (*Cynomys gunnisoni*), whereas hawks in the rural area (i.e. rural hawks) consumed more lagomorphs. We found that exurban hawks experienced greater nesting success and productivity than rural hawks. The presence of prairie dogs, a colonial mammal whose occurrence theoretically reduces predatory search time, may have assisted in the maintenance of relatively high productivity levels for exurban hawks in our study. Flushing distance was considerably higher than that documented in other studies and was negatively related to degree of urbanization. We found that a distance of 650 m prevented 95% of nest-attending Ferruginous Hawks from flushing in response to human approach. We recommend establishing a spatial buffer of this distance or greater to minimize adverse effects of human activities on hawks nesting in New Mexico. Further, prairie dog colonies and habitat supporting other medium-sized mammals (e.g. *Geomyidae*) should be conserved to enable maintenance of Ferruginous Hawk populations in the Western United States, particularly in anthropogenically-altered areas.

G83

Contrasting DNA metabarcoding sampling methods to describe Rough-legged Hawk winter diet

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Determining what animals eat is foundational to their ecology as diet influences many aspects of life history including morphology, behavior, habitat use, distribution, reproduction, and survival. Trace genetic prey remains that can be matched to known gene sequences (also known as "DNA metabarcoding") is a rapidly expanding discipline with the potential to improve our understanding of raptor diet. We collected over 600 diet samples from Rough-legged Hawks (*Buteo lagopus*) throughout their entire North American winter range from October 2020-March 2023. We compared up to eight DNA metabarcoding sampling methods to assess the nonbreeding season diet of the Rough-legged Hawk. Sampling methods included two external body swabs from captured birds (talons and beak), three internal cavity samples from captured birds (one buccal and two cloacal), two fecal sample types (one each from captured and free-flying birds), and prey remains from kill sites. Our objectives were to determine if DNA metabarcoding sampling methods: 1) varied as reservoirs of prey DNA (i.e. proportion of samples containing any prey DNA); 2) varied in the number of prey species detected per sample; and 3) varied in the proportion of total prey species detected among all sampling methods (i.e. proportion of species richness). We found considerable

variation among DNA metabarcoding sampling methods in both the proportion of samples containing prey DNA and number of species detected per sample. We also summarize range wide patterns in the wintering diet of North American Rough-legged Hawks inferred via DNA metabarcoding.

G84

Insect prey diversity, biomass, and parental foraging efforts in Flammulated Owls of northern Utah

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Capturing data on foraging efforts and prey types in nocturnal birds presents various technological challenges. With increasing environmental and climatic pressures on insectivorous migrants, understanding the requirements for feeding their offspring may become crucial in managing and mitigating breeding habitats. Recent advancements of camera and data storage technologies have allowed for the recording of detailed nest activities and frequencies of parental provisioning during critical nestling periods. As part of a long-term study in northern Utah, we deployed modified camera systems in active nest boxes occupied by Flammulated Owls (*Psiloscops flammeolus*) during most of the nestling period over multiple years. Among nests, the proportion of identifiable prey items ranged from 0.695 to 0.547. Most of the prey types delivered to nestlings were nocturnal Lepidopterans (moths; proportions from 0.627 to 0.300) with unspecified insect larvae and Orthopterans (grasshoppers and crickets) alternately ranking as second most delivered types. Biomass delivered per nestling was significantly higher in nests with more successful fledglings ($P<0.05$). Female foraging efforts started increasing (reaching at least 5%) from seven to twelve days since the hatching of the first egg, later matching or exceeding the rates of the male. In several instances females seemed to deliver larger prey items to the nests compared to their mates. Nest territories with fewer abundant invertebrates showed higher frequencies of vertebrate prey supplementing nest provisions. The ability to accommodate the young in increasingly variable habitats will be crucial for the long-term success of natural avian populations.

G85

Into the realm of Harris's Hawks: unraveling social dynamics through VHF telemetry in South Texas

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Our study focuses on the cooperatively breeding population of South Texas Harris's Hawks (*Parabuteo unicinctus)* and aims to document the social behavior of 80 different groups across a gradient of habitats in the Rio Grande Valley. Harris's Hawk social groups were typically comprised of two to three adults and juveniles, with juveniles delaying dispersal for up to one year. For our analysis, we outfitted one member from 12 Harris's Hawk groups (11 juveniles, one adult) with a VHF transmitter to facilitate tracking of the group. Other group members were also captured and fitted with individual color bands to differentiate individuals during group behavioral observations. Using these marked birds, we have been able to collect >100 h of behavioral observations on this population. Once a group was located, we observed their behavior for a minimum of one hour and recorded activity every 60 s. From these observations, we have documented Harris's Hawks cooperatively defending their territories from intruders, engaging in dominance displays such as homosexual copulations and supplanting, and participating in cooperative hunts to pursue prey. We also observed prey sharing, with parents continuing to feed juveniles until dispersal and males sharing prey with their mate before consuming prey themselves. Finally, contrary to the current hypothesis that cooperative hunting evolved to allow Harris's Hawk to pursue larger prey such as Lagomorphs, we commonly observed Harris's Hawks cooperatively hunting and sharing smaller prey items such as rodents, reptiles, and both large and small birds.

G86

Advancing methods of diet analysis: a case study using degraded Merlin prey remains

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Identification of prey remains have long been used as a mechanism to approach diet analyses. As understanding diet is key to comprehending ecosystem dynamics, prey remain identification requires a unique methodological approach to determine diversity within a sample. With the advancement of technology, molecular protocols designed for species-specific identification have improved to incredible accuracy and precision. Yet, the visual identification method has remained a predominant technique within diet studies. We matched visual identifications using entry-level observers with molecular-based methods to quantify the accuracy of the visual identification method. This study determined what fraction of visually identified prey remains could be correctly identified to a high degree of certainty. Using the mitochondrial DNA of >40-year-old Merlin (*Falco columbarius*) prey feather samples, we found that the correct identification of visually identified "high" certainty samples was 42%. Furthermore, visually identified samples with a "medium to low" certainty plummeted to 19%. This study

reveals that correct identification of visually identified samples is significantly lower than previously considered but that certainty level has a significant role in correct identification. Similarly, visual identification can provide rapid determination of separate taxa and the number of species in a sample. It is critical to assess prey remains using multiple techniques in order to procure definitive identification of individual prey items. Additionally, the primers AWF2-R4 and AWF4-R6 targeting regions within the cytochrome c oxidase subunit-1 gene are effective for degraded (i.e. >40 years old) feather samples of Passeriformes and Charadriiformes.

G87

A conservation plan for Golden Eagles in eastern North America

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Although Golden Eagles (*Aquila chrysaetos*) are one of eastern North America's apex predators, the eastern population of this species has only recently been given recognition and study typical of such ecologically important taxa. With this new focus in mind, we present here an initial conservation plan for the species. Golden Eagles breed across every eastern Canadian province except Newfoundland; the species no longer nests in the eastern USA. Their migration follows leading lines and birds overwinter in nearly every eastern state, although numbers seem greatest in the central Appalachians. Best estimates suggest that there are >5,000 birds in this apparently stable population. There is substantial cultural significance assigned to Golden Eagles, both globally and in eastern North America, and Native American Tribes of the Great Lakes region have Golden Eagle clan members. Although once ignored in regional management plans, the population now has special conservation status in most eastern states and provinces. Nevertheless, eastern Golden Eagles face several anthropogenic threats including illegal shooting, collision with vehicles and infrastructure, poisoning, inadvertent trapping, effects from energy development, electrocution, disturbance, habitat alteration, and climate change. Based on the evaluation of the current situation, threats, and knowledge gaps for eastern Golden Eagles, we developed a set of proposed conservation objectives for this population. These include: (1) maintain or increase breeding population size; (2) protect habitat in breeding, migration, and wintering areas; (3) maintain or develop long-term monitoring programs for the population; and (4) reduce threats and anthropogenic causes of mortality.

G88

Rapidly declining Peregrine Falcon population in New Mexico, USA, during 2016-2023

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After the conclusion of post-delisting monitoring in 2015, we began monitoring a representative sample of Peregrine Falcon (*Falco peregrinus*) nesting habitat, building on data extracted from statewide monitoring that began in 1979. The study area covers three degrees of both latitude (34-37° N) and longitude (105.5-108.5° W) in northern and central New Mexico, USA. Eighteen representative tracts in the study area were surveyed each year, including 47 known breeding territories that cover a full range of elevations and habitats. A territorial population of 40 adult pairs in 2016 decreased by 30% to 28 adult pairs in 2023, an average decline of 4.6±2.8% (95% CI) annually. Population decline was not uniform, as territories in prime habitat generally remained occupied. Productivity averaged only 1.08±0.16 young per adult pair during 2016-2023, annually ranging

from 0.46 to 1.43, with the lowest productivity in 2022. Long-term data show that productivity peaked in the late 1980s and has been critically low since 2007, with delayed egg-laying and increasing breeding failures. Causes of low productivity are unknown, but are persistent. With limited monitoring in the western USA since 2015, the geographic extent of low productivity and declining territory occupancy is unknown, but our data suggest that more widespread monitoring is urgently needed.

G89

Conservation status and prospects of critically endangered vultures in Ghana and Togo, West Africa

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West African raptors have exhibited precipitous declines in recent decades, coinciding with steep losses in natural habitat and mammalian wildlife driven by rapidly increasing and expanding human populations. Among the most threatened species in Africa, vultures are particularly affected but data on their populations and ecology remain lacking in countries including Ghana and Togo. Between 2020 and 2022, we conducted surveys in Ghana's largest protected area, Mole National Park, where we estimated populations of 3–4 White-headed Vultures (*Trigonoceps occipitalis*), 25–74 White-backed Vultures (*Gyps africanus*), and 29–36 Hooded Vultures (*Necrosyrtes monachus*). We also documented the first nest records for Hooded Vultures (N=6) in this area, together with the first nest records for White-backed Vultures (N=10) and White-headed Vultures (N=1) in Ghana. In neighboring Togo, extensive poaching and habitat destruction, including inside national parks and other nominally protected areas, has resulted in declines and extirpations of many wildlife species, including large mammals and birds. From 2021 to the present, we have conducted vulture surveys in Togo, where White-headed Vultures are now considered extinct and a single White-backed Vulture was sighted in 2019, with no observations of this species since then. Small numbers of Hooded Vultures persist in Togo and feed at outdoor slaughterhouses, as shown by our counts at five major urban areas. However, vultures and other globally threatened raptors, including Martial Eagles, are highly threatened by poaching for a burgeoning and lucrative West African wildlife trade, in which raptor heads and other parts command the highest prices.

G90

Abundance, distribution, and conservation status of diurnal raptors at southern wetlands of Benin, West Africa

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We assessed raptor abundance, distribution, and threats in southern Benin, West Africa, at two wetland sites listed under the Ramsar convention, the Lac Ahémé complex and Bas-Ouémé complex, where few prior systematic surveys have been carried out. We conducted field surveys by canoe during the dry season, from December 2022 to March 2023, when low water levels provided abundant fishing opportunities for raptors. We counted a total 1,874 individuals of 17 diurnal raptor species at 673 locations, including three families Accipitridae (11 species), Pandionidae (one species) and Falconidae (five species). Nearly one third (29%) of these species were wintering Palearctic migrants, two thirds (65%) were permanent residents, and 6% were intra-African migrants. The most frequently detected Palearctic migratory raptor, the Osprey (*Pandion haliaetus*), was observed at >80% of sites visited. We also documented both the Palearctic Black Kite (*Milvus migrans migrans*) as well as the closely related inter-African migrant Yellow-billed Kite (*Milvus migrans parasitus*). Wetland islands with sacred forests, which still contain large trees, provide important nesting and roosting habitat for raptors. Major threats to raptors in this region include hunting and trapping for regional fetish markets for use in belief-based rituals. Raptors and their carcasses and parts may fetch some of the highest prices in these markets, for which the most highly persecuted raptors included the Yellow-billed Kite, Shikra (*Accipiter badius*), Dark Chanting Goshawk (*Melierax metabates*), African Goshawk (*Accipiter tachiro*) and Osprey. This study confirms the national and international importance of southern Benin wetlands for raptors and their conservation.

G91

Rapid and recent range collapse of Australia's rarest raptor, the Red Goshawk

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Australia's Red Goshawk (*Erythrotriorchis radiatus*) is a taxonomically distinct raptor endemic to the tropics and sub-tropics of Eastern and Northern Australia. It is

considered Australia's rarest raptor, is the largest of its *Accipiters*, and exhibits among the highest rates of reverse-size sexual-dimorphism in the world. The status and range of this enigmatic species remains poorly known as no comprehensive analysis of its range-wide population trends has ever been undertaken. This creates a knowledge gap which potentially delays urgent conservation management given there is anecdotal evidence of regional-scale extirpation. Here we bridge that knowledge gap by compiling a comprehensive dataset of occurrence records spanning the species' historical range and analyze it for population trends between 1978-2020 at national, state, and regional scales. To do so, we developed a novel method of data handling that overcomes reporting biases centered around nest locations. Our results suggest that the species has declined significantly across Eastern Australia and is likely locally extinct in many regions. We estimate the Red Goshawk has disappeared from 34% of its breeding range over the last four decades, and probably persists at extremely low density, if at all, over an additional 29.7% of its breeding range. These results demonstrate the species' declining population trajectory at multiple scales for the first time and justify its recent up listing to e*ndangered* under both IUCN and Australian criteria. We recommend population surveys and monitoring in extant areas, and research targeted towards determining the threats driving this species widespread decline.

G92

Restoring Barbary Falcon population in Saudi Arabia by using a novel technique

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The ancient tradition of falconry has been nowhere as popular as in the Middle East. Traditional Arab falconry was an excellent example for sustainable use of wildlife. Falcons were trapped in fall, used for hunting until spring when they were released. Thus, populations remained intact, and the survival of first-year birds (mostly used for falconry) were ensured through their most critical first winter. That changed dramatically when falcon populations started to decline after WWII, and technical and financial circumstances made it possible to keep falcons throughout summer. Uncontrolled harvest without release lead then to the decline of falcon populations. In the Kingdom of Saudi Arabia (KSA), the Barbary Falcon (*Falco peregrinus pelegrinoides*) population decreased to ~30 from the estimated 6-700 pairs by 2015, due to uncontrolled harvest. In 2020, Saudi Falcon Club and Tilad have launched Hadad Project to restore Barbary Falcon population in KSA. The project used the fact that falconers had trapped females selectively, thus the remained population was dominated by males. In spring females were released – by using hacking – in single males' territories when levels of sexual hormones were high. As a result, the number of pairs doubled to 65 in just two years. Most pairs even bred successfully already in the first year. In 2021 and 2022, 326 chicks fledged giving a boost to the population. Parallel to the restoration project, trapping of all falcon species, but the migratory Peregrine Falcon (*F. peregrinus peregrinus/calidus*) were banned further supporting the restoration of falcon populations in KSA.

G93

Conservation of a threatened species with stakeholders on Grouse Moors in the English Uplands

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The Hen Harrier (*Circus cyaneus*) inhabits moorland habitat in Scotland and Northern England. It has a conservation status of Red in the United Kingdom. The major reason for this status is heavy persecution because of conflicts between Hen Harriers, who readily hunt young Red Grouse (*Lagopus scoticus*) during the breeding season, and the moorland owners who run costly and profitable shoots for grouse. After ten years of consultation between the government, stakeholders, and various conservation NGO's, a six-point plan was formed. The fifth point on this plan was Brood Management. This entails removing broods from nests within 10 km of each other, rearing the broods in captivity to reduce the pressure on the grouse, then releasing them back to the wild once they are full grown, in approximately the same areas. Over the last four years, working with Game Keepers and Landowners the population has grown from virtually no Hen Harriers in the Uplands of Northern England to 119 young, fledging in 2022. Although this project was and is still a political hot potato, working hand in hand with stakeholders seems to be effective in reducing the persecution at this time. This paper will explain the reason behind the trial, the methods and the results so far.

G94

The return of the White-tailed Eagle to England, UK

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The White tailed- Eagle (*Haliaeetus albicilla*) has been absent as a resident breeding bird in England for over 200 years. Like many birds of prey, the White-tailed Eagle suffered relentless persecution from the Middle Ages onwards. The Last known pair in southern England bred on Culver Cliff in 1780 on the Isle of Wight. A five-year reintroduction project began in 2019 to translocate and release White-tailed Eagles on the Isle of Wight, a small island off the South Coast of England. The donor population was sourced from Scotland

in which there are now around 150 breeding pairs which also originated from a translocation project with Eagles from Norway being brought over in 1968. All of the WTE's released from the Isle of Wight have been fitted with Ornitela satellite tags enabling us to monitor their movements, habitat selection preferences, diet, mortality and pair bonding and breeding behavior thus far.

G95

Using large-scale datasets to inform management of raptor populations

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Management of broadly distributed raptor populations in the context of Federal regulatory processes poses unique challenges. The U.S. Fish and Wildlife Service (USFWS) requires a way to set consistent standards for permitting decisions nationally that allow USFWS to meet specific management objectives. Large-scale surveys or modeling efforts often allow better comparisons across large areas, however, they may not reflect local movements or abundance with the same precision as smaller-scale efforts. Ideally, we can find ways to leverage the strengths of the different approaches to best inform a particular management question or need. USFWS recently proposed using Cornell Lab of Ornithology's relative abundance estimates (derived from a model that uses heavily filtered eBird data as basis for bird abundance) as part of the eagle incidental take permitting framework. We discuss the objectives and how we evaluated the suitability of relative abundance for this purpose, including other datasets considered. In an analysis for Bald Eagles (*Haliaeetus leucocephalus*) for example, we found that map cells that had greater than or equal to median non-zero relative abundance values across all seasons accurately accounted for more than 90 percent of known high use sites in the other data sets such as Breeding Bird Survey routes, nest sites, and mid-winter concentration areas. We also discuss interest in incorporating local data into combined or hierarchical modeling frameworks and the challenges to doing that in a consistent and pragmatic way.

ABSTRACTS

LIGHTNING TALKS

LT01

Testing adaptive flexibility in breeding Swainson's Hawk nest selection

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Mismatches between habitat quality and selection can occur as a result of anthropogenic change. In long-lived territorial species like Swainson's Hawks (*Buteo swainsoni*), these mismatches may pose serious risk to population viability. One of the longest running raptor studies in North America has tracked breeding in a population of Swainson's Hawks in Butte Valley, California since 1979. Swainson's Hawks exhibit strong site fidelity to territories on their breeding grounds. The majority of breeding pairs have established territories around, or in close proximity to, irrigated farmlands producing hay varieties (e.g. alfalfa [*Medicago sativa*]), a habitat that provides abundant prey and has increased over the study period. However, in recent years, other crop types are growing in popularity and may be replacing alfalfa fields. Thus, this long-term dataset is ideal to test whether adaptive habitat selection is operating as habitat conditions have changed over time. I will create generalized linear models to assess territory occupancy (a measure of habitat selection) and reproductive success (a measure of habitat quality) over time and as a function of varying habitat compositions. This research aims to examine the influence of time lags in Swainson's Hawk response to shifting agricultural crops in the Butte Valley over time. This information will provide a test of the adaptive breeding habitat selection hypothesis for Swainson's Hawks, and will have implications for understanding how the Butte Valley Swainson's Hawk population may respond to climate-driven changes in land use.

LT02

The reintroduction of Osprey's to Ireland

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In Ireland Ospreys remain absent as a breeding population. However, there are many records of sightings of Osprey in Ireland, both older records and from more recent times spanning from 1940-2022. The sightings were concentrated along the eastern and southern coasts of Ireland, both on spring and autumn migration, with an increase in the frequency of sightings in the last 20 years, possibly due to an increase in the British population. As records were largely from the east and south of the country, a release station was chosen on the southeast coast as a release area. In summer 2023 a translation project began with birds sourced from Norway and transported to Ireland. The first step in establishing a breeding population in Ireland.

LT03

Modelling territory occupancy of large falcons in Hungary

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The Peregrine Falcon (*Falco peregrinus*) and Saker Falcon (*F. cherrug*) are two large falcon species regularly breeding in Hungary with a population of 114 and 175 pairs in 2022, respectively. While the population of the Peregrine Falcon is still increasing, the increase of the Saker Falcon population stopped around 2010, and has fluctuated since then. In our study, we used the software RPRESENCE to estimate territory occupancy rates and trends of the two species between 2012-2021. We found that territory occupancy of Peregrine Falcons was driven by colonization, and more than 90% of the territories were occupied at any given year in the period. Once a territory was occupied, it likely remained occupied in subsequent years. Occupancy rate for Saker Falcons varied between 50%-60% at any given year (although occupancy was also driven by colonization), which means that more than 40% of available territories remained empty in each year. For Saker Falcons, we found that about 50% of the territories were occupied in 7-10 years (good quality territories), and 50% in 1-6 years (poor quality territories). When investigating other variables, we found evidence that the density of Common Starlings (*Sturnus vulgaris)* was higher in good quality territories than in poor quality territories. This might explain our results of Saker Falcon territory occupancy, because the starling is an important prey species, but other covariates must also be investigated as a next step to better understand this species' biology.

LT04

Do Verreaux's Eagles fly at night? Implications for future wind farm developments

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To meet present and future energy demands, South Africa requires an increased and diversified portfolio of energy generation, including a rapidly growing wind energy sector. However, wind turbines have been shown to have detrimental effects on avian species, particularly large soaring raptors. Efforts are being made to understand the habitat use and movements of species particularly sensitive to wind energy generation to help inform development guidelines and mitigation measures. Verreaux's Eagle (*Aquila verreauxii*) is one species that is often impacted by wind developments in South Africa. One proposed mitigation measure for reducing eagle collisions is to curtail wind turbines during the day when they are located in close proximities to nests, and to only have them operational at night. Using GPS tracking data from 16 Verreaux's Eagle, collected between 2011-2022, we assess the potential efficacy of this proposed mitigation method and examine nocturnal movements at multiple time intervals. We found that there were relatively few nights where Verreaux's Eagle undertook movements. Movements >1 km occurred on less than 1% of nights (between 0.80% to 0.92%, depending nocturnal hours examined), but smaller night movements (>250 m) were more common, ranging from 3.2% to 3.75% (depending on night period used). Studies such as this have the potential to maintain raptor protection while increasing the land made available for wind energy development; thereby creating a solution to a green-green dilemma.

LT05

Golden Eagle winter feeding

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Golden Eagles (*Aquila chrysaetos*) in North America are well below carrying capacity due to habitat degradation and human-caused mortality. Winter poses significant challenges for Golden Eagles, including reduced food availability and increased competition. In Utah's West Desert, HawkWatch International and the Department of Defense have undertaken a Golden Eagle winter feeding research project. Carrion, consisting of 18 carcasses weighing a total of 2,187 pounds, has been sourced from the Utah Division of Wildlife and local ranchers to place at feeding sites. This supplemental food resource enhances the chances of survival during challenging winter months. In addition, a passive perch scale has been placed next to the carrion to measure the weight of eagles as they come in to feed. Close to 300 color bands have been deployed on Golden Eagles, enabling the tracking and identification of individuals. Through resighting efforts, 11 color band resightings have been recorded, providing valuable insights into movement patterns, survival rates, and behavior. The combination of color band resightings and carrion placement provides an opportunity to evaluate the efficacy of the winter feeding program. This research project contributes to a better understanding of the ecological dynamics of Golden Eagles during the winter season, guides conservation practices, and enhances knowledge regarding the benefits of supplemental feeding.

LT06

The effect of roadside noise and pairing status on the foraging success of wintering American Kestrels in North Texas

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Many raptors exhibit adaptability to living in human-dominated landscapes, yet few studies have examined whether raptors become habituated to anthropogenic-caused noise levels in these environments or remain there despite human activities. American Kestrels (*Falco sparverius*) wintering in North Texas concentrate along urban roadsides that offer short-grass habitats and power lines from which to hunt. Over three winters, we investigated whether roadside sound level influenced kestrel foraging success in Denton and Dallas Counties. We hypothesized that sound level would not significantly affect kestrels' foraging success due to their habituation to anthropogenic landscapes. We conducted 30-min observation sessions of wintering territorial kestrels (N=24), recording foraging attempts, successes, and sound level. Based on 103 sessions, the average sound level was 62.53 dBA (range: 43-75.2 dBA). To test the effects of sound level on foraging success rate, we fit a binomial generalized linear mixed model using pairing status, sex, temperature, and time of day as additional fixed predictor variables and individual as a random effect. Randomization tests were used to determine the significance of each variable in predicting foraging success. The only significant predictor of foraging success was pairing status (N=999 simulations, P=0.03). Conversely, roadside sound level showed no effect on foraging success (N=999 simulations, P=0.77). Paired kestrels exhibited an average foraging success rate of 71.02% ± 3.33% (SE), whereas unpaired kestrels exhibited an average success rate of 49.54% ± 8.34%. Our data suggest that kestrels become habituated to noisy anthropogenic environments and that remaining paired during winter may confer a foraging advantage to both members.

LT07

Observations of Bat Falcon hunting behavior in western Mexico

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From November 2022 to April 2023, I spent two days per week observing a pair of Bat Falcons *(Falco rufigularis)* hunting over a small pond in western Mexico. The purpose of this study was to document the small falcons with photographs and to determine the types of prey that was being hunted. Arrival to the study area was ~10 minutes before sunrise and staying on location for ~2 hours each morning. The falcons started their pursuit of prey from a branch of a dead tree, climbing rapidly into the sky above the small pond. They would typically reach heights of anywhere between 20-100 m above the pond. From that point, direct pursuit of the prey occurred. Once the prey was either captured or missed, they would return to one of the dead trees to consume they prey or wait to pursue again, usually within five to 10 minutes. Almost all of prey items captured were Scarab beetles (*family Scarabaeidae*), and were too difficult to identify to species level. There was one instance where a female Bat Falcon came back with an unidentified bird. This study shows that during the winter months in west Mexico, Bat Falcons are predominantly insectivores. It would be interesting to study other sites in the region to see what types of prey Bat Falcons eat.

LT08

Translocation of Merlins to protect the endangered Piping Plover

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Despite great efforts to recover the population of Piping Plovers (*Charadrius melodus circumcinctus*) in the Great Lakes, its growth appears to have stalled in recent years. Multiple evidence indicates that the guilty of this stagnation would be a natural predator: the Merlin (*Falco columbarius*). We propose an adaptive management experiment that will: 1) evaluate how effective translocations are at non-lethally controlling Merlin populations, and 2) estimate the minimum necessary spatial extent of future control operations by quantifying Merlin home range and foraging ecology. During the 2022 breeding season we deployed nine tags (GPS-Argos), and during the 2023 we deployed 28 tags of different types (13 GPS/Argos, 3 GPS/GSM and, 12 GPS/VHF). The project plans to capture at least 15 individuals to be translocated with transmitters and at least 21 individuals to be used as controls (without translocation). Translocated individuals will be moved at least 100 km from the area where they were captured to areas with similar characteristics. Controls will be released in the same area they were captured. Through demonstration of the effectiveness of non-lethal Merlin control, we will develop a set of best management practices that can be used within the Great Lakes and at other breeding and nonbreeding sites. Moreover, satellite and GPS tagging will provide some of the first information on Merlin migration, home range, and space use dynamics.

LT09

An experimental approach to assess scavenging dynamics in roadside areas

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The increase in human road networks has become a threat to biodiversity. Roads are mortality blackspots, which accumulate daily carrion from roadkill in quantities that are difficult to quantify. This carrion availability may be an opportunity as a food resource for scavenger species, but only for those able to cope with a highly disturbed and risky traffic environment. Here we designed a field experiment simulating the roadkill scenario to reveal which species take advantage of this resource in semiarid habitats of central Argentina. We artificially placed carcasses of the species more frequently found road-killed in the area, the European Hare (*Lepus europaeus*). We set 12 carcasses next to the road (<4 m), and 13 in control places at 500-1000 m from the road. We used camera traps to record the scavenger that feed on them. Roadside carcasses took longer to detect and consume by scavengers than in a realistic scenario. Species richness was similar (nine vs. seven species), but species diversity was lower in roadside areas where species attended in low abundances. Southern Caracara (*Caracara plancus*), Chimango Caracara (*Milvago chimango*), and Grey Fox (*Lycalopex griseus*) benefited from roadkill carrion resources. This study reveals that only a few bold individuals of scavengers can cope with the trade-off of feeding on carrion in a risky environment. Our results open questions about the effects of human infrastructures in shaping scavenging dynamics and how individual tolerance to a traffic disturbance may play a significant role in carcass removal in roadside areas.

LT10

Recovery of a historically persecuted Golden Eagle breeding population in the Trans-Pecos Region, West Texas, USA

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Thousands of Golden Eagles (*Aquila chrysaetos*) were shot from aircraft in southeastern New Mexico and western Texas in the 1950s and 1960s. While many of these eagles were migrants from more northern breeding populations, abundance of local breeding populations was likely depressed. Persecution continued less intensively though the 1970s. An extensive fixed-wing survey of suitable Golden Eagle nesting habitat in 1980 documented only 13 occupied nests within an ~43,500 ha mountainous region of western Texas known as the Trans-Pecos. In 2016, we documented 63 occupied nests during a rotor-winged survey of the same region. A rolling average of August roadside rabbit counts conducted by Texas Parks and Wildlife showed comparable prey populations during the two Golden Eagle nest surveys 36 years apart. A continued shift away from sheep and goat grazing in the region, replaced in part by hunting leases for native and exotic ungulates, has likely slowed persecution so that the breeding population has recovered. Two of five Golden Eagles marked with GPS receivers/satellite transmitters in the Trans-Pecos in 2016 were shot, indicating that persecution continues, but apparently not at historical levels, as evidenced by the approximately five-fold increase in the size of the breeding population.

LT11

Polygyny in Barred Owls: cooperative breeding between two females and a male at the same nest

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As part of a decade-long study of Barred Owls (*Strix varia*) nesting in suburban neighborhoods in Charlotte, North Carolina, USA, when most mated pairs would have been laying eggs, we encountered three Barred Owls in very close proximity in February of 2002. We trapped and banded one of these birds, which based on plumage, was a bird hatched in the previous year. We did not discover a nest in the vicinity of where we found the birds. In 2005 we re-encountered three owls in this area after broadcasting territorial calls. We trapped and radio-tagged an adult female with a fully developed brood patch, which turned out to be the immature bird we tagged in 2002. We discovered the nest that these three birds were using and set up a video camera to record their nesting activity. Both females were incubating a clutch of eggs simultaneously, with one female incubating the eggs and the second female incubating on top of the female on eggs. In one recorded prey delivery, the male passed a prey item to a female perched at the rim of the nest cavity. That female turned and passed the food on to the female that was incubating at the time. Polygyny has been recorded in at least eight owl species, but never in Barred Owls

LT12

The major threats faced by endangered Egyptian Vultures in Uttar Pradesh, India

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The population of Egyptian Vulture (Neophron percnopterus) is declining throughout the world. There are many potential areas in Uttar Pradesh, India which must be addressed on a priority basis and conservation steps cannot be undertaken until the causes can be identified. During our research we have identified several negative factors that have influenced the population of Egyptian Vultures in Uttar Pradesh. The threats were classified among 14 districts of Uttar Pradesh, from 2014-2019, and it was observed that lack of awareness was found as the common threat found in 12 districts of 14 districts surveyed. The assessment conducted is based solely on the accessible data and thus cannot provide complete information about the situation. Lack of awareness, Road accidents, prevalent myths, increased population of feral dogs, Habitat destruction and electrocution are the major threats observed. Other threats observed were closure of slaughterhouses and modifications in waste disposal system, natural calamities, painting of old buildings and temples, death of nestlings due to starvation and dehydration etc. As there are significant numbers of both the subspecies of Egyptian Vultures in Uttar Pradesh, any kind of threat may have a very disastrous effect on the global population and therefore should be considered as a major concern for the protection of these globally endangered species.

ABSTRACTS

RRF POSTER PRESENTATIONS

P01

Structured citizen science to unravel the distribution of raptors with discreet habits: The first census of wintering Short-eared Owls in Portugal

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Citizen science has proven to be very useful in ornithology, including for informing the distribution of inconspicuous raptors. Short-eared Owls (*Asio flammeus*) are present in Portugal during winter, where their reduced vocal activity, low density and crepuscular habits hamper their detection. Nevertheless, the overall decline of its European populations emphasizes the importance of determining its distribution in Portugal, estimating the size of the wintering population, and establishing a baseline for future assessments. To accomplish this, we assigned regional coordinators to 20 areas, who recruited amateur observers and distributed them across pre-selected priority areas. In December 2021 and January 2022, the participants conducted sampling points with playbacks at sunset, followed by car transects. This sampling effort totaled 400 h and resulted in the recording of 91-112 wintering Short-eared Owls in Portugal. The 178 volunteers allowed for extensive coverage of the priority areas. The results support the previously known relevance of areas such as the Tagus estuary, but raised some concern, especially about the Sado estuary, where it was thought to be more abundant in the '90s. The census also yielded the first record in the Castelo Branco area. The extensive coverage of suitable habitat areas for the species would likely be unattainable without the involvement of so many volunteers, and this is of major importance to unravel the distribution of discreet raptors. This shows that directed and structured citizen science can play an important role in unravelling the distribution, and addressing knowledge gaps about raptors, regardless of their cryptic habits.

P02

Anticoagulant rodenticide exposure and toxicosis in Bald Eagles in the Eastern United States from 2012-2023

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Bald Eagles (*Haliaeetus leucocephalus*) are apex predators that can suffer relay anticoagulant rodenticide (AR) toxicosis from consuming exposed prey. Brodifacoum, a highly toxic and commonly used AR, is of particular concern. More data regarding exposure, frequency, and the significance of postmortem liver AR concentrations are needed to better assess population-level impacts on Bald Eagles. Our goals were to assess frequency of exposure to AR, diversity of compounds detected, range of liver compound concentrations, and concurrent hemorrhage in Eastern USA Bald Eagles. We assessed diagnostic data from Bald Eagles submitted from 16 eastern states from 2012-2023. Liver samples were tested for eight AR compounds at the California Animal Health and Food Safety Laboratory. Of 218 samples, 170 (78%) had detectable brodifacoum levels, and 89 (41%) had detectable levels of multiple compounds. Quantifiable

levels of brodifacoum, ranging from 25-1500 ppb, were detected in 53 (31%) samples, with trace levels in 117 (69%). Anticoagulant rodenticide toxicosis was diagnosed in 14 (26%) eagles with quantifiable levels and 11 (9%) with trace levels. Hemorrhage was identified grossly or microscopically in 132 (78%) brodifacoum-exposed cases, 80 (61%) of which were diagnosed with trauma, precluding diagnosis of AR toxicosis. We demonstrated that Bald Eagles are frequently exposed to multiple AR compounds, quantifiable and trace liver concentrations can be associated with toxicosis, and frequent concurrent trauma may confound assessment of the true prevalence of toxicosis in eastern USA populations. Further, AR exposure may increase the risk and/or severity of traumatic injury and death in Bald Eagles.

P03

The unexplored potential of captive breeding research using the California Condor as a model species

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Captive breeding of endangered raptors has helped bring species back from the brink of extinction, namely, the Mauritius Kestrel (*Falco punctatus*), the Peregrine Falcon (*Falco peregrinus*), and the California Condor (*Gymnogyps californianus*). Despite its value within species conservation, captive breeding research is rarely found in the scientific literature, with only 10% of all wildlife reintroduction papers mentioning captive management. We suggest further exploration of captive breeding research using the California Condor as a model species. The California Condor population increased to 561 individuals from only 22 wild birds remaining in 1982, partially because of captive breeding. This is an exceptional accomplishment given that condors are particularly challenging to breed in captivity due to delayed maturity and low reproductive output. Though 73% of all living condors in the USA were hatched and raised in captivity, only 23% of all condor research involves captive birds. We aim to compile and analyze up to 30 consecutive years of California Condor captive breeding records, including behavior, egg morphometrics, and young development. These data, collected from individuals that are now free-flying, will allow us to link early life traits to survival and reproductive information, and can be used to answer many questions on topics like uneven sex ratios and the prevalence of non-breeding adults in the Arizona/Utah population. Results will help inform conservation scientists, as well as provide detailed guidelines for the establishment of future captive breeding programs for similar vulture species, particularly important in light of the alarming decline in African vulture populations.

P05

South Florida Red-shouldered Hawks differ genetically from the eastern subspecies

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Red-shouldered Hawks of the south Florida subspecies (*Buteo lineatus extimus*) are paler and smaller than typical eastern Red-shouldered Hawks (*Buteo lineatus lineatus*) and can nest in very different habitats such as wetlands and grasslands with only scattered trees. We analyzed 11 microsatellite loci to evaluate population differentiation between the south Florida birds and two populations of eastern Red-shouldered Hawks in southern Ohio. We found significant genetic differentiation between the south Florida and eastern populations (F_{ST}=0.053 – 0.097), as well as significant differentiation between the two populations (suburban and rural) of the eastern subspecies (F_{ST}=0.043 – 0.047). Standardized genetic distance principal components analysis indicated two clusters; individuals from the two Ohio populations formed a single cluster and those from Florida formed a second cluster. The substantial differences between the south Florida and other subspecies suggest the south Florida birds may warrant attention and management as a distinct conservation unit, particularly in light of threats including habitat loss and rodenticide exposure.

P06

Golden Eagle abundance in Alaska: migration counts and movement data generate a conservative population estimate

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We paired migration count and GPS-tracking data collected near Gunsight Mountain, Alaska, in a Bayesian framework to estimate the number of Golden Eagles (*Aquila chrysaetos*) in south-central Alaska. We estimated 1,204 potentially breeding (4 yr. old) Golden Eagles annually moved through the Gunsight Mountain migration corridor and summered over an area of 150,000 km2 in south-central Alaska, equating

to a density of 0.80 potentially breeding eagles/100 km2. By extrapolating across the species' nesting range in Alaska (1,180,489 km2) and incorporating published productivity and age-specific survival rates for eagles, we estimated 12,717 Golden Eagles of all ages occur in Alaska, annually. We propose this as a conservative statewide population estimate considering we used methods that likely underestimated population size. Even so, our estimate is three to five times larger than previous estimates and likely represents about one quarter of the USA's population.

P07

Migratory strategies and morphology of American Kestrels

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Demanding energetic requirements associated with migration result in selective pressure on the morphology of birds to make them more aerodynamic. Birds that remain resident on the breeding grounds may not have the same selective pressure for aerodynamics. Therefore, migrant and resident individuals in the same breeding population may have differences in wing length, tail length, and overall mass. American Kestrels (*Falco sparverius*), the smallest falcons in North America, vary in their migratory behavior across the continent, creating excellent opportunities for comparative studies. We examined the relationships between migratory strategy and morphology of American Kestrels in Idaho's Treasure Valley, where kestrels are partial migrants, and Camas Prairie Centennial Marsh, Idaho, where kestrels are a fully migrant population. We determined the migratory status of Treasure Valley kestrels using stable hydrogen isotope analyses on claw samples taken during the time of breeding. We predicted that migrant kestrels would have longer tails and wings, and lighter mass compared to resident kestrels, but these differences may be smaller between residents and migrants within the Treasure Valley where birds of different migratory strategies may mate. Results from our study will provide further insight into the relationships between migratory strategy and morphology within bird populations.

P08

Golden Eagle resource selection at multiple spatial and temporal scales in Yellowstone National Park's northern range

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Fundamental to species conservation is understanding how species use their habitat. As such, wildlife management uses current knowledge of how species interact with available resources. Resource selection is the use of resources relative to their availability, assessed across multiple spatial and temporal scales. Golden Eagles (*Aquila chrysaetos*) are a North American species of conservation concern. Territories in the northern range of Yellowstone National Park (YNP) are relatively dense, however, average reproductive rates over the past twelve years (2011-2022) have been low (Productivity=0.32, Nest success=27%). To aid in understanding Golden Eagle reproduction in YNP's northern range, we empirically identified habitat components selected by eagles at two spatial scales (home range and within home range) during seasonal periods influential to reproduction. We used a hierarchical random effects resource selection function (RSF) in a Bayesian framework to estimate the relative probability with which eagles would select resources at two spatial scales and across seasonal periods. We chose this approach to simultaneously provide inferences of resource selection by individuals and the population. Preliminary results suggest that that Golden Eagles select home ranges in areas with low forest cover and near open water. Within the home range we found that Golden Eagles select for increasingly rugged topography and upper slopes increasing to ridgelines. Additionally, we found some limited evidence that eagles are selecting prey habitat differently in different seasons. The resource selection analysis reaffirms the importance of increased openness and topography near prey habitat on eagle presence and daily needs.

P09

Depredation of the endangered Aeʻo (Hawaiian Stilt) by a native raptor, the Pueo (Hawaiian Short-eared Owl) on the island of Oʻahu, Hawaiʻi

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The Hawaiian Islands have a high rate of species endemism but also one of the highest rates of species loss. Introduced predators on island ecosystems have been identified as one of the most significant causes for the decline of native birds. The control and removal of those predators is a key component of the active management strategy for the conservation and the recovery of native endangered species across the Hawaiian Archipelago. However, depredation by native predators on native prey also takes place, causing serious conservation challenges. Here, we describe four

different events that provide evidence of Pueo (*Asio flammeus sandwichensis),* a sub-species of Short-eared Owl (*Asio flammeus*), depredating Ae'o (*Himantopus mexicanus knudseni*), an endangered subspecies of the Black-necked Stilt (*Himantopus mexicanus*). This occurred during the 2019-2021 Pueo and Ae'o breeding seasons in a wetland area on the island of O'ahu: (a) a two to three weeks old Ae'o chick freshly caught by an adult Pueo; (b) the discovery of at least 10 post-fledgling to adult Ae'o carcasses and remains near an active Pueo nest; (c) the observation of Pueo actively chasing Ae'o; (d) a game camera photo of a Pueo standing at an active Ae'o nest. To our knowledge, these observations are the first published accounts of Pueo depredating this waterbird subspecies. Further investigation is needed to determine potential impacts to the breeding success and overall survival of Ae'o across the Hawaiian Archipelago when compounded with depredation by introduced, invasive predators.

P10

An experimental investigation of the influence of green plant material in raptor nest microclimate

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Many raptor species place green plant material on their nests during incubation and nestling rearing periods. Several hypotheses have been proposed to explain this behavior; the generally accepted, but unconfirmed, explanation is that greenery functions as a repellent to ectoparasites. We experimentally examined the alternative hypothesis that fresh greenery may meaningfully modify the microclimate of raptor nests and our study species was the Mississippi Kite (*Ictinia mississippiensis*). We predicted that addition of fresh greenery would 1) increase humidity at nests, 2) decrease temperature at nests, 3) provisioning of greenery would be correlated to periods of low humidity and high temperature, and 4) tree species used for greenery would release more moisture per unit volume compared to species not used. Our pilot study examining hypothesis 1 and 2 consisted of comparing a sample of replica nests with and without 10 g of fresh willow (*Salix* spp.) greenery. Our preliminary data indicate the effect of adding greenery was rapid and dramatic, with maximum treatment differences of a 63.6% increase in humidity and a 7.1% decrease temperature. Further, the addition of greenery influenced nest humidity for 13 h and temperature for 9 h. We will be conducting the full study during the 2023 nesting season and provide complete results and analysis. If pilot study data are verified by our full study, our results may be a relevant factor for raptor conservation, as arid regions are experiencing increased temperatures and decreased humidity due to a changing climate.

P11

Quantification of lead in feathers of Eastern Screech-Owl and Barred Owl using portable X-ray fluorescence analyzer

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Anthropogenic activities radiate metal contaminants, where these pollutants inadvertently bioaccumulate in local avifauna. Heavy metal elements, such as Pb, biomagnify hierarchically upward through the trophic levels. This makes birds of prey an exceptional bioindicator for monitoring local environmental health and long-term conservation efforts. Non-lethal sampling methods to observe this are preferred, with feathers being of special importance as researchers can also include museum specimens for historical accounts. Unfortunately, the most common practices are cost prohibitive and destroy the feather sample, thus making it unavailable for future studies. An alternative method, the portable X-ray fluorescence analyzer, has emerged as a robust instrument for in-vivo Pb measurements in human bones and has been applied to collected bone samples of various birds. The device is handheld, non-destructive to the sample, and produces metal composition data within five minutes. This project compares feather Pb values from 15 individuals of Eastern Screech-Owl (*Megascops asio*) and 20 members of Barred Owl (*Strix varia*) from central Florida using portable X-ray fluorescence analysis. The two species inhabit similar environments but will avoid one another to prevent predation. This interspecific dynamic offers a trophic point of view for portable X-ray fluorescence Pb analysis.

P12

Fighting *Philornis* (Diptera: Muscidae): increasing productivity of an endangered insular raptor

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The Puerto Rican Sharp-shinned Hawk (*Accipiter striatus venator*, hereafter PRSSH) is an endangered endemic raptor whose population is restricted to the Cordillera Central Mountains of Puerto Rico. As observed with many neotropical birds, a leading cause for its population decline is nest failures due to *Philornis* spp. (hereafter *Philornis*). These flies' larvae penetrate the nestlings' integument and feed on its tissue and blood and are linked to a high rate of nestling mortality. It is suggested that parasitism by *Philornis* represents a severe mortality factor in small and threatened bird species, increasing their extinction risk. Between 1983-1991, the PRSSH

experienced a sharp decline (~40%) with the primary cause of nest failure being due to *Philornis* infestations. To increase the productivity of the PRSSH, we began preventatively treating nests with a 1% solution of PermaCap CS, an insecticide containing permethrin, and/or treated nestlings with a topical application of less than 0.05 cc of Fipronil per 10 g. To determine the effectiveness of nest treatment against *Philornis*, we monitored and managed 56 nests from 2015-2022 and compared the resulting productivity rates of treated and untreated nests. Treated nests (N=15) reached a productivity of 2.0±1.06 fledglings/nest attempt, whereas untreated nests (N=41) yielded a productivity of 0.97±1.23 fledglings/nesting attempt. Nest productivity increased by an average of 104% (t54= 2.84, P= 0.006) when treated against *Philornis*. This study presents effective management techniques that have shown to dramatically increase the likelihood of nestling survival.

P13

Key findings from a study of Cooper's Hawk demography in Albuquerque, New Mexico

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The 2023 Raptor Research Foundation Conference is being held within a 72-km^2 urban study area in Albuquerque, New Mexico, where we have studied Cooper's Hawk (*Accipiter cooperii*) population size, fecundity, survival, and movements for over 12 years. From 2011-2022 we monitored 818 nesting attempts at 138 unique nesting territories and color-banded 657 Cooper's Hawks, 187 of which also were equipped with radio- or GPS-tags. The number of nesting territories occupied annually has ranged from 48-92, with an increasing trend through 2017. Annual nest success has ranged from 78% to 98%, and annual mean brood size per occupied nesting territory at fledging ranged from 3.3 to 3.9. Survival during the first year of life averaged about 20% for both sexes; annual survival among older individuals averaged 75% and 81% for females and males, respectively. Estimates of population size on our study area at the time of fledging in July ranged from 286–513 across years. Fledgling females that settled in urban Albuquerque (~46%) remained year-long residents whereas individuals that dispersed further (~56%) migrated to wintering areas between southwest Texas and central Mexico. Fewer males migrated than females, but we know little else about male migration. The population is regulated mainly through density-dependent male survival and density-dependent emigration and immigration among females. Our work has shown that the study population has been a significant source of female immigrants for surrounding non-urban areas.

P14

Effects of diet on Golden Eagle nestling health, post-fledging survival, and dispersal in southwestern Idaho

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Large-scale landscape alterations due to differentiating land use and climate change have significantly influenced diet shifts in breeding pairs of Golden Eagles (*Aquila chrysaetos*) located in southwestern Idaho. Despite shifts towards profitable prey like ground squirrels and marmots (family Sciuridae), and ducks (family Anatidae), the proportion of jackrabbits (Lepus spp.) in eagle diets is the only prey item positively associated with nestling survivorship. We examined the relationships between diet and several metrics of health including hematocrit, growth rate, and mass to better understand how diet affects nestling health. In addition, we examined whether diet could mitigate the effects of *Haematosiphon inodorus*, a blood-sucking ectoparasite commonly found in the nests of Golden Eagles. Finally, we examined whether nestling diet affected post-fledging survival and dispersal. Understanding the role of preferred prey in sustaining nestling health can help us better predict how bottom-up effects of landscape change can influence fecundity in top-level predators.

P15

Movements and range of Crested Caracaras in Arizona

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Since 2017, we have monitored Crested Caracara (*Caracara plancus*) nests and attached GPS/GSM transmitters to 10

fledgling caracaras in southern Arizona with the objectives of assessing their seasonal movements and improving our understanding of the species' range in the state. Individual caracaras have traveled over an area of more than 15,000 km^2 foraging regularly in Sonoran Desert Scrub, in alfalfa and recently disked cotton fields, and in irrigated cattle and sheep pastures. Several individuals have spent many days on the Tohono O'odham Reservation in southern Arizona, and two individuals traveled to northwestern Mexico but after several months returned to central Arizona. All tagged caracaras often spent multiple consecutive days foraging in a particular area then roosting in Sonoran Desert Scrub adjacent to that foraging area, over multiple nights. Similar to roosting behavior of caracaras in Florida, tagged caracaras in Arizona traveled among a network of consistently used communal roosts throughout the study area.

P16

Dispersal movements of marked Harris's Hawks among territories in south Texas

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Previous research has demonstrated that juvenile Harris's Hawks (*Parabuteo unicinctus*) throughout their range delay dispersal and remain in their natal territory for 12 to 36 months. We have captured Harris's Hawks with bal-chatri traps and marked them with coded anodized bands in south Texas since 2018. Also, at accessible nests, we banded nestlings with coded bands. In most years (2018-2023), we attempted to census territories in both spring/summer and winter and re-sight banded hawks. We have documented that some juvenile and adult auxiliary Harris's Hawk group members do not remain with the groups in which they were originally marked. We have observed the apparent integration of (43) hawks into different groups from 2018 to 2023. When comparing mean distances moved for the hawks related to age, we found that the average dispersal distance for nestlings was 8.3 km (range of 3.5-17.9 km, N=5), the average distance moved for juveniles was 8.9 km (range of 1.5-20.1 km, N=12), and the average distance moved for adults was 11.8 km (range of 1.6-71.9 km, N=26). There was no significant difference in the average distance moved between nestlings/juveniles and that of adults (P=0.784). Males dispersed further (mean=11.9 km) than females (mean=7.8 km), but this difference was not significant (P=0.362). Our findings seem contrary to the reported male-biased philopatry observed in most species of birds.

P17

Extreme weather events: the hottest, wettest and coldest year leads to serious decline in Barn Owl populations in southwestern Canada

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Extreme weather events are negatively affecting species globally and increasing the risk of extinction events. In 2021, between 25 June to 1 July, the Pacific Northwest experienced a heat dome and over a 100 temperature records were broken. The timing of the heat dome (25 June to 1 July) in the Fraser Valley, British Columbia coincided with the nesting season for many birds, and Barn Owl (*Tyto alba*) nest monitoring documented that owlets were severely affected by the extreme weather event. 32% (N=87) of the monitored owlets that were between 20–45 days old in the western portion of our study area perished during this period. For all sites where owlets died, the entire clutch of young owlets perished, equating to a total of 11 failed nest sites (N=40) during this period. No second nesting attempts were recorded. The hot summer was followed by the wettest fall and coldest winter on record for the region. Consequently, recruitment of young was severely impacted by the heat dome and adult winter survival was reduced due to floods in November, and cold weather with snow in December and January. In the eastern Fraser Valley, only 13 nest boxes out of 109 (12%) were occupied. In the Western portion of the valley 77% (N=65) of monitored nest sites were active, but at accessible sites the fledging rate was low at 1.9±1.1 owlets per nest site (N=39). Mitigation measures to prevent heat exhaustion in boxes will be discussed.

P18

California Condor interactions with human residential properties in Southern California

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In spring of 2021, more than one dozen California Condors (*Gymnogyps indicus*) visited the residence of Cinda Mickols in Tehachapi, California, USA. The story garnered national attention and sparked a national interest in the condor recovery program and condor conservation. Our research inquiry was centered around understanding the frequency and magnitude of condor visits to residential properties in California. We used telemetry data from satellite and GPS telemetry units attached to condors in both southern and central California to track and classify condor visitations to residential properties within the state from 2020 to 2022. Consistent with recent publications

on condor movements, condors spent a substantial amount of ground foraging events in areas of human habitation, particularly in the Tehachapi mountain area of Southern California. Moreover, condor visits to human residential areas increased over time and the numbers of condors visiting such sites also increased. We discuss the implications of these increased direct human encounters for self-sustained free-flying condor populations in California and in other areas where condors are being reintroduced.

P19

The habitat composition of Harris's Hawk territories in South Texas

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Harris's Hawks (*Parabuteo unicinctus*) have been studied intensively in New Mexico and Arizona with groups occupying land with very little human activity and primarily inhabiting scrub desert habitat. Our study aimed to identify groups in the South Texas population of Harris's Hawks and examine their habitat characteristics. From 2018 to 2023, 80 groups of hawks have been identified. Using information from previously established literature and ArcGIS pro, habitat size was estimated at ~1.5 km buffer around the centroid of a territory – typically recognized as the nesting site. By using zonal statistic functions in ArcGIS software, we found that the hawks occupied territories consisting of wetland and cultivated cropland landcover types while inhabiting 20% of the available thorn scrub habitat. The dominant land cover type was a significant predictor of Harris's Hawk group size (P=0.04), with smaller groups (2-3 members) inhabiting developed land and larger groups (4-7 members) inhabiting natural land. Likewise, imperviousness ranged from 0-67% within the estimated territory buffers and had a significant negative relationship with Harris's Hawk group size (P=0.01). This pattern seems to support the idea that greater sociality or cooperative hunting is favored in the more natural landscapes. Relatedly, perhaps smaller groups are better able to subsist in the more urbanized sites. Additionally, south Texas Harris's Hawk territories were located in areas with a variety of 13-15 land cover types present. We suggest that Harris's Hawks select sites with diverse land cover types to access a wider range of prey.

P20

A detailed analysis on the effects lead exposure has on Turkey Vulture migratory flight depending on multiple external variables

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Turkey Vultures (*Cathartes aura*) are exposed to lead from fragmented ammunition in hunted carrion. Our previous results indicate that migrant Turkey Vultures have higher lead concentrations than southern California residents, possibly thanks to the 2019 California ban on lead ammunition for hunting. Lead exposure predicts lower flight altitudes and movement rates in resident Golden Eagles (*Aquila chrysaetos*). We hypothesized a similar effect on Turkey Vultures, possibly exacerbated by the metabolic stress of migration. We tagged, collected blood samples, and placed trackers on three migrant Turkey Vultures. The migrants had the following blood lead concentrations 5.6, 6.0, and 10.7 µg/dL. We calculated altitude above ground level with the R package elevatr, used the package SDLfilter to remove speeds judged biologically implausible, and removed points with poor satellite precision. Our preliminary analyses indicate that the Turkey Vulture with the highest blood lead concentration had 39% lower flight speed compared to the two other migrants (Tukey's HSD: $P<0.0001$). Future developments will include the tagging of additional birds, and the extraction of environmental data to control for the effects of weather and topography on flight. We will determine when Turkey Vultures are utilizing orographic and thermal uplift for soaring flight and test for cognitive impairment by analyzing the effect of lead exposure on the Turkey Vulture's altitudinal gains and turning angles. We hope our study will contribute to understanding the behavioral effects of lead exposure on Turkey Vultures and promote additional regulatory actions if deemed appropriate.

P21

Investigating impacts of redlined neighborhood management on wildlife habitat and Cooper's Hawk occupancy in urban Denver, Colorado

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Understanding how socioeconomic decisions influence wildlife resource management in urban environments is becoming increasingly important as humans continue to build urban landscapes at a rapid pace. Examining how wildlife interacts with historically segregated neighborhoods impacted by redlining practices (i.e. discriminatory practice that consists of the systematic denial of services to residents of certain areas, based on their race or ethnicity) will help establish how they may be affected by urban development discrepancies. I study the core habitat decisions made by nesting Cooper's Hawks(*Accipiter cooperii*), in Denver County, Colorado, to evaluate how these

urban specialized predatory birds use the variable tree, vegetation, and built resources in different neighborhoods. There were distinct patterns of nest occupancy during the breeding season. This research investigates the percent tree canopy cover, percent built area, and the Normalized Difference Vegetation Index (NDVI) in Denver to explore what features of the urban environment are most impactful to core nesting habitat choice and explores whether those resources align with specific redlining grades. The average nearest-neighbor distance was extremely close for the species, and successful nests were grouped in certain redlining grades, but occupancy was equally explained by non-interactive tree canopy cover and redlining grade, suggesting that redlining grade may be influencing the birds in more ways than I evaluate here.

P22

A GPS-telemetry study on intraspecific variation in home range size and overlap of ʻIo – the Hawaiian Hawk

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Understanding intraspecific variation in home range dynamics is essential for comprehending the spatial utilization of a species on a landscape scale. This is particularly relevant for raptors, as individuals can demonstrate diverse space-use strategies driven by demographic need. In the context of data-deficient endangered species, such as the Hawaiian Hawk or ʻIo (*Buteo solitarius*), comprehending the home range dynamics of individuals can offer vital insights for ongoing conservation monitoring initiatives. We are conducting a study monitoring the space use of 46 individual ʻIo equipped with solar GPS/GSM transmitters to evaluate the impact of intraspecific variation and seasonality on home range size and degree of space-use overlap. Our objective is to assess variations in home range size and overlap among conspecifics during the breeding and non-breeding seasons. Preliminary findings have revealed intriguing patterns, with some ʻIo demonstrating multiple areas of space utilization during breeding/non-breeding seasons, and home range dynamics are indicating larger space utilization and higher degrees of overlap in forested areas compared to rural neighborhoods. This research contributes to the existing ecological knowledge on ʻIo by expanding upon previous home range estimates, while also providing insights into carrying capacity by elucidating how individuals partition or share space over time. The results offer valuable information for conservation efforts and will be used to help support our conservation partners and significantly enhance our understanding of ʻIo's spatial ecology.

P23

New monopole transmission towers could be facilitating American Kestrel breeding range expansion into novel areas

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American Kestrels (*Falco sparverius*) are a small, cavity-nesting falcon. Recent advances in eBird data increased the resolution available abundance maps of this species. These new abundance maps show a peculiar trend throughout central Texas, with kestrels breeding in a continuous line south along the I35 interstate. At the southern edge of their nesting range in north Texas, we found 92.8 to 100% of American Kestrel nests occurred inside steel monopole transmission towers. I hypothesized that the presence of these towers may provide novel nesting habitat for American Kestrels in areas where large tree cavities were not historically available, allowing kestrels to breed within the mesquite savannahs of central Texas. To test this, I acquired energy infrastructure mapping data from the USA Energy Atlas, depicting transmission line locations. I downloaded eBird data of American Kestrel observations in the month of June from 2018 through 2022 in 16 contiguous central Texas counties. Because of the often-imprecise nature of eBird upload locations and our observations of kestrels routinely perching over 1 km from the nesting cavity, we buffered the transmission lines with a 1 km radius. We found that 68.6% (290 of 423) of kestrel observations occurred within 1 km of a transmission line, despite the buffered area accounting for only 45.6% of the available land area (17,203 of 20,548 km$^{2)}$. This significant disparity indicates that kestrels may be purposely selecting to nest within or near transmission lines. These preliminary results would benefit from further spatial analyses and ground-truthing of potential nesting sites.

P24

Examining variation in feather hydrogen isotope (δ^{2H}_{f}) values in a small forest owl using samples of known-origin

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Evaluating movement behavior is vital for fully understanding a species' ecology. Methods used to study movement and migratory connectivity range along a continuum of cost, sample size, and amount/quality of data. The use of intrinsic markers, like stable hydrogen isotope (deuterium) composition, has the potential to be an

affordable and productive method for studying movement behavior at large scales. However, studies using deuterium in bird feathers (d2Hf) have demonstrated mixed success and shown that a better understanding of how d2Hf varies spatially, temporally, within/among species is necessary. Here we examine d2Hf variation in the Northern Saw-whet Owl (*Aegolius acadicus*), a widespread breeding resident in northern North America, whose nonbreeding distribution is not fully resolved. Samples were collected from juveniles of known-origin (N=87) and parents (N=25) at 26 nest-sites located in three regions: Quebec (CA), South Dakota and Nebraska (USA). Using a set of GLM models and an AIC approach, we explored the relationship between d2Hf of juveniles and a set of covariates. Based on what has been demonstrated in avian literature, we predicted d2Hf would vary among regions, by seasonal precipitation, and body condition. Our results demonstrate total precipitation (year prior to feather growth) and latitude to be important in predicting d2Hf enrichment. Additionally, our results demonstrate differences in d2Hf enrichment between juveniles and their parents, as well as among juveniles within the same nest. Our results help inform the use of d2Hf in studies of cryptic species like the Northern Saw-whet Owl.

P25

Using feathers and blood to understand lead exposure rates in Golden Eagles migrating across Montana

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Lead poisoning causes morbidity and mortality in Golden Eagles (*Aquila chrysaetos*) with exposures suspected to be from inadvertent consumption of lead-based ammunition when scavenging on carcasses. Although blood is used as a common biomarker of lead exposure, blood only integrates lead exposure over ca. two weeks while sequential feather samples provide information about lead exposure over the timeframe of feather growth (~2 months). The goal of this project was two-fold: i) measure lead concentrations in paired blood and feathers samples to determine the relationship between these two biomarkers of exposure, and ii) measure lead concentrations in sequential feather samples to better characterize the frequency and magnitude of lead exposure in migrant Golden Eagles. Paired blood and flight feather samples were collected from ~40 wild-trapped migrant eagles in Montana by the Teton Raptor Center in September and October of 2020 and 2021. Samples were analyzed for lead concentrations using ICP mass spectrometry. Preliminary feather data illustrate that ~50% of eagles had a lead exposure event (estimated blood lead >5 µg/dL) over the timeframe of feather growth. Incidentally, our analyses also suggested a few eagles were exposed to elevated levels of mercury. Our results can be used to help understand the frequency of lead exposure in Golden Eagles and other avian scavengers in North America.

P26

Inferring the source of population growth of Peregrine Falcons in southern Nevada using microsatellite and genotyping-by-sequencing analysis

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Peregrine Falcons (*Falco peregrinus*) were considered to be extirpated as a breeding species from Nevada from the 1950s until 1984. In 1985 the first breeding pair was discovered along the Lake Mead shoreline in southern Nevada, with 83 known nesting territories documented by 2019. Survey data suggested contemporary population growth, but increased survey effort may have influenced the observed increase. In this study, we collected 73 samples from 12 peregrine nesting territories in southern Nevada from 2008-2019 to determine whether the population in southern Nevada was growing intrinsically or whether the apparent expansion was driven by emigration from outside the study area. We collected feather samples from nestlings and resident adults trapped during the breeding season, and from molted feathers collected in eyries and recovered carcasses of adults and nestlings. Genotyping-by-sequencing and microsatellite analysis of 12 loci was performed on DNA extracted from the samples. Preliminary analysis of the microsatellite data indicates our observed heterozygosity was similar to or lower than expected values, and allelic diversity (3.33 alleles/loci) was lower than populations in Canada (5.82) and Norway (4.36) in the early 2000s. A tree diagram generated from genotyping-by-sequencing data indicates a high a degree of clustering of individuals by location and region (including two outgroup samples from California). Collectively, the data suggest that the population in southern Nevada has grown intrinsically with a high degree of relatedness between individuals and relatively low allelic diversity. Future analyses will include additional samples from northern Nevada and coastal California.

P27

It's getting hot in here: climate effects on parasitic relationship between Burrowing Owls and fleas

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An interesting host-parasite relationship occurs between Western Burrowing Owls (*Athene cunicularia hypugaea*) and *Pulex irritans* (Siphonaptera: Family Pulidae), commonly named the "human flea." *P. irritans* is a cosmopolitan species of flea that typically parasitizes mammals, which makes its association with Burrowing Owls remarkable. Moreover, the association between *P. irritans* and Burrowing Owls essentially occurs only in the Pacific Northwest region of the United States, even though both species have broader distributions. Molecular studies confirm that *P. irritans* feed from Burrowing Owls, so these fleas are truly parasitic on owls, and that Burrowing Owls are not simply phoretic hosts. Although this association was first reported in the early 1900s, most aspects remain poorly understood. We were interested in understanding factors underlying spatial and temporal variation in fleas on Burrowing Owls. Using long-term data (1997-2023, > 900 nests) we asked if and how variation in winter and summer precipitation and temperature affected the intensity of *P. irritans* on Burrowing Owl nestlings in the Morley Nelson Snake River Birds of Prey National Conservation Area, located in southwestern Idaho, USA. Our poster explores these and other questions about factors affecting distribution and abundance of *P. irritans* on Burrowing Owl nestlings.

P28

American Kestrels in northeast Illinois and heavy metals

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The American Kestrel (*Falco sparverius*) is the smallest falcon in North America. Since 1966 kestrel populations have decreased approximately 53%. Although a complex question, potential causes for decline include loss of nesting habitat, nesting structure, competition from other species for nests, contaminants, predation on both adults and chicks, climate issues, or a combination of these. Bird banding is a regular activity in the Forest Preserves of Cook County in Illinois and feeds into multiple research projects. When banding kestrels, we collect the typical banding information as well as draw blood for heavy metal testing. Heavy metal results could indicate possible contamination issues. Blood is collected from the jugular or brachial artery using a 25- or 27-gauge needle. The amount collected is less than 1% of its body weight. A drop of blood is placed on a dried blood spot (dbs) card. The sample needed for testing is (50 uL). Any additional blood collected can be evaluated for other health related issues. The samples are sent to the Michigan State University Veterinary Diagnostic Laboratory (MSU VDL). The sample is then tested for arsenic, cadmium, mercury, lead, selenium, and thallium contamination. The first 25 samples that have been tested showed no arsenic, cadmium, or thallium. Selenium, mercury, and lead on all but one bird had similar values. That one bird in question had significantly higher values of all three elements. This project will continue into the future as more samples have been collected and submitted for analyses.

P29

Three years of raptor monitoring at the Luis Fernando Chavez's station in Nicaragua

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In 2019, the non-profit agency Paso Pacífico created the first monitoring station of raptors in Nicaragua. Located in the municipality of San Miguelito, Río San Juan, in the south-eastern side of the country, the station was created to assess the number of migratory raptors travelling through Nicaragua. The station was named "The monitoring station of raptors Luis Fernando Díaz Chávez" in memory of the Nicaraguan ornithologist Luís Díaz (QEPD). Throughout the three years of monitoring (2019, 2020, 2022), a total of 16 species were detected, with Turkey Vultures (*Cathartes aura*), Swainson's Hawks (*Buteo swainsoni*), and Broad-winged Hawks (*Buteo platypterus*) as the most frequently observed species. For instance, in 2019, a total of 1,290,605 raptors were counted: Turkey Vultures were the most numerous with 803,369 individuals (62.2% of the total counts), followed by Swainson's Hawk (343,153 individuals, 26.0%), and Broad-winged Hawks (42,605 individuals, 3.3%). In 2020, a greater number of raptors was observed compared to 2019, with a total of 1,834,524 individuals: Turkey Vultures remained the most abundant with 1,093,729 individuals (59.6%), followed by Swainson's Hawks (337,480 individuals, 18.4%), and Broad-winged Hawks (395,718 individuals, 21.6%). Finally, 2022 was the year with the highest number of raptors counted of all three years, with a total of 2,374,738 raptors: Turkey Vultures (1,462,757 individuals, 56,2%), Swainson's Hawks (340,529 individuals, 13.08%), and Broad-winged Hawks (491,853 individuals, 18.89%).

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