

Raptors in a Changing World



Photo by Kate Davis

Raptor Research Foundation



2010 Annual Meeting Program and Abstracts

Fort Collins, Colorado
September 22-26, 2010



Raptor Research Foundation • 2010 Annual Meeting • Fort Collins, Colorado
Conference AT-A-GLANCE

WEDNESDAY, Sept. 22		LOBBY	
12:00-5:00 pm	Registration		
12:00-5:00 pm	Vendor Setup		
THURSDAY, Sept. 23		SALON D	SALON E
7:00 a.m-5:00 pm	Registration (Lobby)		
8:00-8:15 am	Welcome and Announcements (Salon D): Local Conference Committee		
8:15-8:30 am	Welcome (Salon D): Darin Atteberry, Ft. Collins City Manager		
8:30-9:20 am	Plenary Speaker (Salon D): Dr. Pat Shipman, What is a Bird? An Evolutionary Approach		
9:20-10:00 am	<i>Coffee Break</i>	<i>Coffee Break</i>	
10:00 am	J. Dwyer , Testing Survey Methods for...	M. Scholer , Using Woodpeckers to...	
10:20 am	M. Etterson , Detectability Analysis of...	R. Conrey , Rainfall and Plague Influence...	
10:40 am	J. Barnes , Call-Broadcast Surveys for...	S. Chiavacci , Nesting Success & Failure...	
11:00 am	M. Larson , Pre-Nesting Survey Methods...	S. Salafsky , Prey Abundance/Weather...	
11:20 am	C. Briggs , Apparent Nest Success vs...	R. Tinajero , Habitat Fragmentation and...	
11:40 am	L. Priestley , Determining Phenology of...	J. Bednarz , Sibling Aggression in...	
12:00-1:40 pm	<i>Lunch (Early Career Raptor Researchers' Lunch - Offsite)</i>		
1:40 pm	D. Whittington , The New USFWS Eagle...	J. Brown , Rain & Reproductive Timing...	
2:00 pm	W. Voelker , Native Culture in Conflict...	S. McCann , Nesting & Provisioning...	
2:20 pm	B. Watts , Eagle Economics in the...	R. Milgater , Precipitation, Phenology...	
2:40 pm	M. Martell , Contaminants in Bald Eagle...	J. Heath , Recruitment of Second Year...	
3:00-3:40 pm	<i>Coffee Break</i>	<i>Coffee Break</i>	
3:40 pm	K. Steenhof , Off-Highway Vehicles and...	M. Kochert , Use Frequency of Golden...	
4:00 pm	B. Washburn , Bird-Aircraft Strike Hazard...	D. Bird , Ecology of Urban-Nesting Bald...	
4:20 pm	C. Kendall , Old World Vultures and...	R. Crandall , Golden Eagle Nesting...	
4:40 pm	M. Gercken , Goshawk Occupation of a...	J. Smallwood , Vocalizations of...	
FRIDAY, Sept. 24		SALON D	SALON E
7:00 am-5:00 pm	Registration (Lobby)		
8:00-8:40 am	Keynote Speaker (Salons D and E): Bruce MacDonald, Perspectives on Climate Change		
8:40 am	N. Nemeth , West Nile Virus in Raptors	L. Baril , Declines in Bald Eagle and...	
9:00 am	W. Iko , West Nile Virus Infection at the...	L. Baril , Peregrine Falcons in...	
9:20 am	A. Franklin , West Nile Virus and Spotted...	D. Smith , Yellowstone Raptor Initiative...	
9:40-10:00 am	<i>Coffee Break</i>	<i>Coffee Break</i>	
10:00 am	M. Saggese , West Nile Virus and St. Louis...	D. Bystrak , Raptor Banding Records at...	
10:20 am	T. Felix , Prevalence of <i>Taxoplasma gondii</i> ...	J. Lutmerding , Raptor Encounter...	
10:40 am	N. Nemeth , Avian Influenza Viruses in...	C. Farmer , Raptor Banding and...	
11:00 am	Panel: Raptors and Zoonotic Infections	J. McNicoll , Changing Reasons for...	
11:20 am	I. Caballero , Genetic Patterns of...	A. Hull , 25 Years of Raptor Banding at...	
11:40 am	F. Hogan , Breeding Behavior of the...	G. Niemi , 38 Years of Raptor Banding...	
12:00-1:40 pm	<i>Lunch</i>	<i>Lunch</i>	
1:40 pm	B. Breen , Farmers and Turkey Vultures...	O. Allen , 40 Years of the Cape May...	
2:00 pm	B. Bedrosian , Eagles and Lead Rifle...	S. Slater , Spatial Temporal Assessment...	
2:20 pm	G. Holroyd , The Clarion Burrowing Owl	D. Varland , Peregrine Falcons on...	
2:40 pm	T. Nygård , The Reintroduction of the...	C. McIntyre , Mortality & Winter Range...	
3:00 pm	J. Barclay , Population Dynamics of a...		
3:20-3:40 pm	<i>Coffee Break</i>	<i>Coffee Break</i>	
3:40 pm	D. Gossett , History and Trajectory of...	L. Mojica , GPS-Satellite Transmitters for...	
4:00 pm	D. Bell , Radio-tracking Prairie Falcons...	C. Kendall , GPS Transmitters and...	
4:20 pm	J. Klucsarits , A Population Update of...	M. Wallace , Patagial Tag/Transmitters...	
4:40 pm	D. Bird , Reversing the Decline of...	S. Weidensaul , Geolocators and Raptors...	
5:00 pm	H. Snyder , A World Class Raptor Area...	K. Bildstein , The Future of Raptor Banding	

Only the presenting author's names and shortened titles are provided for brevity. Please see the full schedule for complete information.

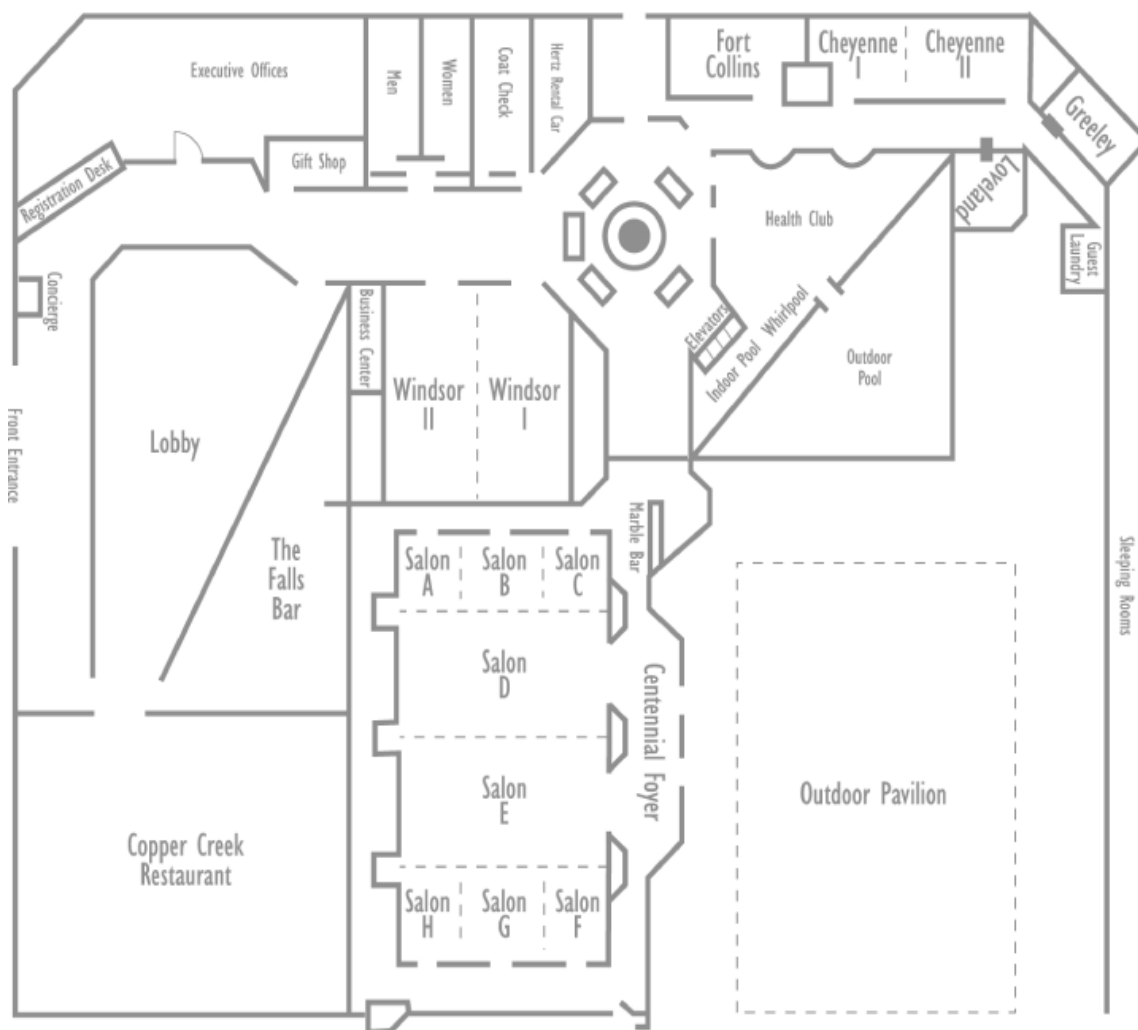
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Conference AT-A-GLANCE

SATURDAY, Sept. 25	SALON D	SALON E
8:00 am	G. McKee , Trends for Raptors, Prey,...	
8:20 am	S. Slater , Oil and Gas Activities and...	K. Duffy , Instilling Raptor Appreciation...
8:40 am	N. Morgan , Raptor Tolerance to...	K. Davis , Raptors in the Creative Process
9:00 am	C. Kemper , Utilities' Raptor Nest...	J. Scherpelz , Creativity and Flexibility...
9:20 am	J. Mason , Methane Burners: Better...	W. Voelker , The Comanche Ethno-...
9:40-10:00 am	<i>Coffee Break</i>	<i>Coffee Break</i>
10:00 am	J. Smallie , Camera Traps & Cape Vulture...	K. Lacy , Raptors' Role in Age-...
10:20 am	V. Pope , Collision Potential at a...	J. Parks , The Cornell Approach to...
10:40 am	R. Lehman , Interpretation of Raptor...	F. McCorkle , Uses of Falconry Training...
11:00 am	P. Juvvadi , Bird Electrocutations on...	J. Dawson , Extended Free Flight: Avian...
11:20 am	R. Harness , Electrocution Assessment of...	W. Crawford , The Changing Face of...
11:40 am	A. Manville , Minimizing Take by Power...	W. Crawford , The Changing Face..., cont'd
12:00-1:40 pm	<i>Lunch</i>	<i>Lunch</i>
1:40 pm	C. Alvaro , Spanish Windfarm Impact on...	E. Savage , Migratory Bird Educational...
2:00 pm	C. Maisonneuve , Landscape, Windfarm,...	G. Stewart , Research Based Conservation Education
2:20 pm	S. Cole , Wind Farm Compensation for...	S. Slater , Migration Monitoring and...
2:40 pm	P. Sweanor , Wind Energy BMPs for...	D. Moller , Women and Raptors in the...
3:00 pm	D. Whittington , Eagle Conservation & ...	J. Parry-Jones , International Centre for...
3:20-3:40 pm	<i>Coffee Break</i>	<i>Coffee Break</i>
SATURDAY, Sept. 25	SALON F-H	
8:00 am	M. Martell , Golden Eagle Migration between WI and Canada	
8:20 am	T. Booms , Short-eared Owl Migration Routes and Wintering	
8:40 am	G. Proudfoot , Movement and Migration of Saw-Whet Owls	
9:00 am	R. Milgalter , Spatial and Temporal Territory Characteristics	
9:20 am	J. Wiens , Spatial Ecology of Northern Spotted Owls in OR	
9:40-10:00 am	<i>Coffee Break</i>	
10:00 am	E. Moss , Habitat Properties of Golden Eagle Territories	
10:20 am	C. Boal , Relationship of Raptors and Prairie Chickens	
10:40 am	H. Craig , Isotope Signatures to Study Dietary Patterns	
11:00 am	C. Dykstra , Mercury, DDE, & PCB Trends in Bald Eagles	
11:20 am	S. Hindmarch , Risk of Secondary Rodenticide Poisoning	
11:40 am	M. Saggese , Health Assessment of Raptors in Argentina	
12:00-1:40 pm	<i>Lunch</i>	

Only the presenting author's names and shortened titles are provided for brevity. Please see the full schedule for complete information.



Marriott Hotel Conference Center Floorplan





Raptor Research Foundation Annual Meeting

September 22-26, 2010
Fort Collins, Colorado

Hosted by The Rocky Mountain Raptor Program



Co-hosted by the Raptor Research Foundation and EDM International, Inc.





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Laurie Goodrich

At Large #2
Clint Boal

At Large #4
Carol McIntyre

At Large #6
Michael Kochert

Committee Chairs

Awards
Brent Bibles

Conferences
Libby Mojica

Conservation
Position open

**Early Career Raptor
Researchers**
Travis Booms

Education
Jemima Parry-Jones

Membership
Ted Swem

Nominations
Laurie Goodrich

Scientific Program
Jim Bednarz

Conference Committee

Judy Scherpelz, Local Chair

Rick Harness
Kevin Kritz
Lisa Winta

Susan Harness
Libby Mojica
Ken Wilson
Dan Varland



Conference Hosts

Raptor Research Foundation

Founded in 1966, RRF is a non-profit scientific society formed to accumulate and disseminate scientific information about raptors in order to inform the scientific and lay public about the role of raptors in nature and to promote their conservation. The RRF membership, which includes nearly 1000 individuals from over 50 countries, consists of academic researchers, government employees, and others interested in birds of prey. The Journal of Raptor Research is issued quarterly to members and contains the latest research results from raptor studies around the world.

Rocky Mountain Raptor Program

The RMRP is a raptor rehabilitation and education organization that has worked closely with the scientific community for more than 25 years. The RMRP cares for more than 300 injured raptors every year, with the goal of releasing them back into the wild. About 30 nonreleasable raptors form the core of the RMRP environmental education program, which reaches hundreds of thousands of people in Colorado and southern Wyoming every year.

The RMRP works closely with Colorado State University's Veterinary Teaching Hospital to provide medical care for more than 300 injured raptors every year. The organization cooperates with a variety of research projects through CSU, CDC, and USGS studying such challenges as West Nile Virus. After 25 years as part of Colorado State University, we are now a separate nonprofit organization that has recently settled into a new facility on the north edge of Fort Collins.

EDM International, Inc.

EDM is an employee-owned Fort Collins consulting firm providing engineering and environmental support to the electric utility industry, both Nationally and Internationally.

EDM is unique because their diverse staff includes civil engineers, electrical engineers, researchers and wildlife biologists. The blending of these skills allows EDM to be actively involved with Research and Development efforts to develop unique tools to methods to address the impacts of power lines and wind turbines to both birds and bats.



Contributors

Sincere thanks for contributions from the following organizations, which helped to make this event an exciting one.

Center for Disease Control
City of Fort Collins
National Wildlife Research Center
Rocky Mountain Bird Observatory
Fort Collins Audubon Society
Colorado State University
Webmaster: Scott McLaughlin of Heartland Hosting
Dr. Ken Wilson, Professor and Department Head, Department of Fish, Conservation,
and Wildlife Biology, Colorado State University

Conference Moderators

A special thank you goes to the following individuals, who volunteered to moderate the conference sessions:

Jim Bednarz	James Dwyer	Miguel Saggese
Keith Bildstein	Rick Harness	John Smallwood
David Bird	Mike Kochert	Dan Varland
Clint Boal	Nick Komar	Brian Washburn
Travis Booms	Torgeir Nygård	
Kate Davis	Bruce Peterjohn	

Volunteers

We gratefully acknowledge the hard work of volunteers, who made this event possible.

Sheila Boll	Tara Hatfield	Melissa Reyes-Fox
Christine Chapman	Tom Hatfield	Jean Saunders
Nancy Drilling	Dough Johnston	Steven Sheets
Daniel Gossett	Lisa Mason	Joe Simonds
Stephanie Gossett	Audrey Muro	Rachel Simonds
Gillian Gwatz	Julie O'Connor	Karen Uyeda

Host Staff

Judy Scherpelz	Gail Kratz
Lisa Winta	Mike Tincher
Carin Avila	Lynsey Reed
Bob Francella	

We wish to acknowledge and thank Kate Davis, for providing the photographs found in this program, and Shane Chipp, for designing the conference logo. Special thanks goes to Dr. Steve Strauss, Department of Chemistry, Colorado State University, for providing equipment for the conferences.



Field Trip Sponsors

Thank you to all the organizations and individuals who provided field trips for our attendees, including:

Denver Museum of Nature and Science
Jeff Birek, Rocky Mountain Bird
Observatory
Jeff Connors, Rocky Mountain Natl Park
Rocky Mountain Raptor Program

Soapstone Prairie Nature Area
U.S. Fish and Wildlife Service
National Eagle and Wildlife Repository
National Wildlife Research Center

Welcome to Fort Collins!

Set against the backdrop of 14,000 foot peaks, Fort Collins is the gateway to the Rocky Mountains. A variety of ecosystems, from short-grass prairie to high mountain ranges, are within an hour's drive, offering several exciting field trip opportunities for attendees. Late September will offer a peak of fall color for those who choose to experience the aspen in the high country.



Fort Collins has a national reputation for offering a high quality of life. It offers many amenities for the outdoor enthusiasts, including miles of bike/running trails, a bike library for those who wish to explore the area by bicycle, several fitness and climbing centers that offer day passes, fishing on the scenic Poudre River, to name a few. Fort Collins also has a reputation for the number of world-renowned microbreweries including New Belgium Brewing Company. Family members that accompany attendees will be delighted with the variety of activities available to them.

Fort Collins is known for its diverse scientific community and numerous university, state, and federal research entities such as Colorado State University, the Center for Disease Control, the USDA National Wildlife Research Center, the Rocky Mountain Bird Observatory, and the Fort Collins Audubon Society, who will be contributing to the success of the conference.





Vendor and Presenter Information

The Marriott

The Marriott is located in the middle of Fort Collins, two miles south of Historic Old Town. It offers the Copper Creek Restaurant with excellent menus for breakfast, lunch, and dinner; the Falls River Bar offers a tasty dinner and beer, fine wine and spirits. A variety of restaurants are within two miles of the Marriott. The Marriott has a Business Center that includes complimentary computers with internet available to check email, a printer, and a photocopier. Wireless internet is available in public areas of the hotel.

Vendors

Eleven vendors with raptor-related items will be on display in the foyer area outside of the salons Wednesday-Saturday. Vendors include: Bedrosian, BlueSky Helicopters, Buteo Books, Nick Dunlop, Kaddas Enterprises, Rob Palmer, Sentry Guard, Thunder Basin Coal Company, Tyco Electronics, Rocky Mountain Bird Observatory, and Rocky Mountain Raptor Program.

Notes for Presenters

Scientific Papers

Two concurrent paper sessions will be held Thursday and Friday in Salons D and E, with a third concurrent session in Salons F-H on Saturday. The program schedule lists rooms and times for presentations. Papers must be in digital, PowerPoint format, and on memory sticks or CDs. Presenters should download papers to the computer the afternoon or evening before their presentation. Salon F will be open Wednesday 3-6 pm, and Thursday and Friday, from 8 am-6 pm for presentation uploads and reviews. We encourage presenters to run through all of the slides to ensure they are loaded correctly.

Special thanks to the Scientific Program Committee, including Jim Bednarz, James Dwyer, and Rick Harness, for screening a record number of abstracts and preparing them for publication in the program.

Icebreaker

Join old friends and make new ones. Join us at the Icebreaker Wednesday night 6:00-8:00 pm in the Pavilion. Cash bar; refreshments will be served.

Early Career Raptor Researcher Lunch

All participants interested are encouraged to attend the ECRR Thursday noon-1:40 pm. It will be held at the Tres Margaritas restaurant, a short walk from the Marriott hotel. Preregistration is not required. Please contact Travis Booms with questions.



Vendor and Presenter Information

Poster Session and Reception

Please install your posters on Thursday in the Windsor room after 9 am. The poster reception will be from 5:00-7:00 pm, and includes refreshments and a cash bar.

Silent Auction Items

Please drop off your donations to the Silent Auction at the registration tables by Thursday. Lisa Winta (RMRP), will handle the paperwork and placement of items in Salons A-C. The auction will end at 3:30 pm Saturday. We feature artwork, signed books, hawk wine and hawk beer, fine crafts, among other raptor-related items. And the auction helps to defray conference costs.



Eagle Dance

The Iron Family Dancers and Singers will exhibit the various styles of intertribal powwow dancing of the Plains Indian Tribes at the Banquet. Each exhibition dance will include an explanation of the dance regalia and origination of the dance style. A brief biography of each dancer will also be related to the audience. They aim to be highly interactive with the audience, sharing and promoting awareness of the richness of the Native American culture through song and dance, and short stories. If the setup allows, they may include the audience in a couple of social dances.

Tribes of family members present for this performance: Pawnee, Crow, Navajo, Ogalala Lakota, Southern Cheyenne, Kiowa





Field Trips

Field Trips

All field trip groups with provided transportation will meet at the front entrance of the Marriott.

National Eagle and Wildlife Property Repository

Wednesday, September 22, 12:30 pm – 5:30 pm

Come visit the National Eagle and Wildlife Property Repository, operated by the U.S. Fish and Wildlife Service (USFWS) at the Rocky Mountain Arsenal National Wildlife Refuge northeast of Denver, Colorado. The National Eagle Repository portion of this facility provides a central location for the receipt, storage, and distribution of bald and golden eagles that are found dead, and their parts. The eagles, and their parts, are shipped to qualified Native Americans for use in religious Indian ceremonies. During your visit you will also see the National Wildlife Property Repository portion of this unique facility where law enforcement operations of the USFWS stores confiscated animals, animal parts, and products created from them that have been illegally imported into this country. The tour is free but you will need to provide your own transportation to and from the Repository. Trip limited to 30 participants.

National Wildlife Research Center (NWRC)

Wednesday, September 22, 1:00 pm – 3:00 pm

The National Wildlife Research Center (NWRC) is the federal institution devoted to resolving problems caused by the interaction of wild animals and society. The Center applies scientific expertise to the development of practical methods to resolve these problems and to maintain the quality of the environments shared with wildlife.



The Center evaluates damage situations and develops methods and tools to reduce or eliminate damage and resolve land-use conflicts. NWRC scientists study birds, mammalian predators, rodents, and other wildlife that cause serious but localized damage problems. This guided tour of the NWRC will require pre-registration at least two days prior to the tour. No photography or videography is allowed on the tours. 4101 LaPorte Avenue, Ft. Collins Cost: The tour is free but you will need to provide your own transportation to and from the NWRC. Trip limited to 25 participants.



Field Trips

Dinosaur Ridge Hawkwatch Visit

Sunday, September 26, 7:30 am – 1:00 pm

Come see the site with the largest Ferruginous Hawk migration in the world! The site is located just west of Denver near Red Rocks Amphitheater. The views are incredible! This is a spring Hawkwatch site, but we have good potential to see fall migrants including raptors and songbirds on the Ridge. This trip will be guided by Jeff Birek, Biologist for Rocky Mountain Bird Observatory. Jeff has worked as a hawkwatcher/raptor bander in California, Virginia and Veracruz, Mexico. He will give pointers on raptor identification, talk about the history of the site, and point out any winged visitors that show up. The trip includes lunch, snacks, water, and transportation to and from Fort Collins. Trip will depart from the Marriott at 7:30 am and have everyone back by early afternoon. Cost: \$25. Trip limited to 25 participants.



Pawnee Buttes National Grasslands

Sunday, September 26, 7:30 am – 1:00 pm

Join the Fort Collins Audubon Society for a trip to the Pawnee Buttes and points along the way. The Buttes are nesting sites for Golden Eagle and Prairie Falcon, and the area in general is good for Ferruginous and Red-tailed Hawks, and Northern Harriers. On the way to the Buttes, the group may encounter late-departing Swainson's Hawks or even a Merlin. The trip will be led by Nick Komar. Bring your own lunch, snacks, and water as eating options on the prairie will be limited. Transportation will be provided. Trip will depart from the Marriott at 7:30 am and have everyone back by early afternoon. Cost: Free. Trip limited to 12 participants.

Soapstone Prairie Natural Area Visit

Sunday, September 26, 7:30 am – 3:00 pm

Visit Soapstone Prairie Natural Area where cultural and natural history meet in one of the state's largest land conservation projects. This remarkable natural area encompasses 28 square miles conserving one of the last nearly pristine shortgrass prairies in the country and was just opened to the public in June 2009. It is home to many rare and threatened plant and animal species. People have also occupied this land continuously for over 10,000 years and the Soapstone Prairie contains the Lindenmeier Archeological site, a National Historic Landmark, recognized worldwide as one of the most extensive occupations of the prehistoric Folsom culture. This trip will include the following four separate morning events and a combined afternoon event:

Morning Programs (9:00 am – 12:00 noon) Several guided hikes through the prairie will be offered.

Afternoon Program (1:00 – 2:00 pm) Archaeology of Soapstone Prairie: Explore the Archaeology of Soapstone Prairie, home to the Lindenmeier Site, which is considered to



Field Trips

be one of the most significant early-man sites in North America and one of only 3 pre-historic sites in Colorado listed as a National Historic Landmark. (Limit: 50 participants).

The trip will include lunch and transportation to and from Fort Collins. You must bring your own drinking water. Bring a jacket, even if the forecast is for warm weather. Wear sturdy shoes or hiking boots as rattlesnakes and cacti are very common. Trip will depart from the Marriott at 7:30 am and have everyone back by early afternoon. Cost: \$30. Trip limited to 50 participants.

Rocky Mountain Raptor Program Visit

Sunday, September 26, 9:00 am – 11:00 am

Get a behind-the-scenes tour of the facility of the Rocky Mountain Raptor Program, host of the 2010 RRF Conference. The RMRP cares for more than 325 injured raptors each year, with the goal of releasing them back to the wild. Additionally, the RMRP has about 30 nonreleasable birds that are used for environmental education and public outreach. The 8000-square foot building includes medical care facility, classroom, and gift shop. Rehabilitation caging includes a 2880-square foot convalescent cage complex with a 6000-square foot flight/reconditioning cage complex. Education birds are housed in a 2880 square foot cage complex. Participants will be guided through the main facility and caging in groups of 10. Tours will include discussions on rehabilitation philosophy and methods, case management, and the science and art of cage design. Photography is welcomed. Cost: \$5. Trip limited to 30 participants. Transportation is provided.



Rocky Mountain Arsenal National Wildlife Refuge Visit

Sunday, September 26, 8:00 am – 1:00 pm

Come visit the Rocky Mountain Arsenal National Wildlife Refuge, 10 miles northeast of Denver. This area is a 12,500-acre expanse of short grass prairie that has survived the test of time during which it has transitioned from native prairie, to use for cropland and grazing, to a World War II era manufacturing site, to an industrial site, and finally a wildlife sanctuary. It represents a very unique conservation success story and it is a place where wildlife thrives. This Refuge is one of the largest urban wildlife refuge's in the country. An on-going massive re-vegetation effort is underway to restore more than 10,000 acres of disturbed land to native short grass prairie habitat.

The tour will begin at Refuge headquarters with a presentation on the history of the site, native wildlife and the short grass prairie ecosystem, and USFWS efforts to manage and



Field Trips

restore habitats on this area. This will be followed with a bus/tram tour of the Refuge to observe both wildlife and the ongoing management efforts to restore native habitats. Large prairie dogs towns that attract a variety of raptors such as red-tailed and ferruginous hawks are present, and USFWS also has established a resident herd of bison on the area. The trip will include water, a lunch, and transportation to and from Fort Collins. Cost: \$30. Trip limited to 36 participants.

Rocky Mountain National Park Visit

Sunday, September 26, 8:30 am – 3:00 pm

A raptor monitoring program began in Rocky Mountain National Park in 1987. First year survey work identified a high concentration of raptors along Lumpy ridge a 5.6-kilometer by 2.4-kilometer ridge at the east boundary of the park. Twelve birds of prey were found to be nesting, foraging and migrating along this ridge. In addition there are two raptor migration corridors in the park. Raptors begin migrating through the park starting at the end of August and going through September. At times up to 20 raptors per hour are observed and kettles of raptors such as Swainson's hawks are noted. The tour will visit Lumpy Ridge to discuss managing breeding raptors and climbers, drive up Trail Ridge Road to look for migrating raptors moving through Forest Canyon, and discuss nesting high elevation raptors that take advantage of feeding on overweight ground squirrels, chipmunks and marmots that get fed junk food by visitors at viewpoints. Hear how park managers try to manage visitors feeding wildlife. Jeff Connor is a Natural Resources Specialist having worked at Rocky Mountain National Park for 22 years and currently working for the Continental Divide Research Learning Center in the park. He was responsible for the birds of prey and songbird monitoring program for many of those 22 years. The trip will include lunch, snacks, water, and transportation to and from Fort Collins. Cost: \$30. Trip limited to 20 participants. The trip will depart from the Marriott at 8:30 am and have everyone back by mid-afternoon.

Behind the Scenes in the Ornithology Collection, Zoology Department, at the Denver Museum of Nature and Science

Sunday, September 26, 2010 9:00 am – 3:30 pm

Come visit the Denver Museum of Nature and Science for a special behind the scenes look at the Zoology Department Ornithology Collections. On this trip you may see several of over 50,000 specimens, including raptors, and also many other orders and families of birds. The collection houses study skins, mounts, and skeletons dating back to the 1870's, with about 70% from Colorado and the surrounding mountain/plains region, but with coverage from 6 out of 7 continents as well. Collections include type material, such as Gunnison Sage Grouse and subspecies of Bobwhite Quail, as well as extinct species such as Passenger Pigeons, Carolina Parakeet, Huia, Elephant Bird, Ivory-billed Woodpecker, and more. The collection also contains first state records and erratic finds, such as the only known Magnificent Frigate Bird from Colorado. Participants will be guided through the collections for 1.5 hours, and then spend up to 2.5 hours in facilitated free time, behind the scenes, to examine skins or skeletons in more detail. After the behind-the-scenes portion, participants may visit the exhibit galleries for an additional 1 to 2 hours to view the Denver Museum's stunning dioramas, half of which contain birds from Colorado and throughout the world. The trip will include transportation to and from Fort Collins. Cost: \$20. Trip limited to 15 participants



Special Event Schedule

Special Events

Wednesday, September 22th:

6:00 - 8:00 pm **Icebreaker Reception** (Marriott Pavilion)
Refreshments and local beer, plus cash bar.

Thursday, September 23:

8:00 - 8:15 am **Welcome, Local Committee**

8:15 - 8:30 am **Welcome, Darin Atteberry**, Fort Collins City Manager (Salons D&E)

8:30 - 9:20 am **Plenary Speaker, Dr. Pat Shipman** (Salons D& E)
"What is a Bird? An Evolutionary Approach

12:00-1:40 pm **Early Career Raptor Researcher Lunch** (Off-Site)

5:00 - 7:00 pm **Poster Session** (Windsor Room) Refreshments and local beer

7:00 - 7:30 pm **Informal Presentation and Discussion** "The Pallid Color Morph of *Falco peregrinus cassini*: A History of Former Studies, a Summary of Recent work, and Projections for Future Work" by David Ellis et al. (Salon D)

7:30 - 8:00 pm **Photography Presentation** "Flocking Behavior of European Starlings Attacked by Peregrine Falcons" by Nick Dunlop (Salon D)

8:00 - 8:30 pm **Photography Presentation** "Bald Eagles Versus Starlings, and Other Local Raptors" by Rob Palmer (Salon D)

Friday, September 24:

8:00 - 8:45 am **Keynote Speaker, Dr. Bruce MacDonald** (Salons D&E)
"Perspectives on Climate Change"

6:00 - 8:00 pm **Western Barbeque**, hosted by New Belgium Brewery (off-site)

Saturday, September 25:

3:40 – 5:00 pm RRF Business Meeting (open to all members; Salon E)

6:00 – 7:00 pm Cocktail Hour (Salons A-D)

7:00 – 11:00 pm Banquet (Salons A-D)

Sunday, September 26:

Field Trips



Thursday September 23 ♦ Conference Agenda

Thursday, September 23

8:00 – 8:30 am Announcements and Introduction

SALONS D & E

8:30 – 9:20 am **What is a Bird? An Evolutionary Approach.** *Pat Shipman*

9:20 – 10:00 am *Coffee Break*

CONCURRENT GENERAL SESSION I
Techniques

SALON D

Moderator: John Smallwood

- 10:00 am **James F. Dwyer**, James D. Fraser, and Joan L. Morrison
Testing Survey Methods for Crested Caracaras (*Caracara cheriway*) in Florida.
- 10:20 am **Matthew A. Etterson**, Gerald J. Niemi, and Robert W. Howe
Can Detectability Analysis Improve the Utility of Point Counts for Temperate Forest Raptors?
- 10:40 am **Joseph G. Barnes**, Jef Jaeger, and Daniel Thompson
Call-Broadcast Surveys as an Effective Tool for Detecting Breeding Peregrine Falcons (*Falco peregrinus*).
- 11:00 am **Matt Larson** and Denver Holt
Investigations of Pre-Nesting Survey Methods and Inventory of the Short-Eared Owl (*Asio flammeus*) in Western Montana.
- 11:20 am **Christopher W. Briggs**, Michael W. Collopy, and Brian Woodbridge
Apparent Nest Success Versus Daily Nest Survival: a Case Study of Swainson's Hawks.
- 11:40 am **Lisa Takats Priestley**
Determining Phenology of Raptors in Alberta, Canada from Volunteer Nest Cards.

12:00 – 1:40 pm *Lunch*

RAPTOR AND HUMAN-CONFLICTS SPECIAL SESSION (CONCURRENT SESSION)

Moderator: Brian Washburn

SALON D

- 1:40 pm **Diana M. Whittington**, Joel E. Pagel, Robert K. Murphy, and Eric Kershner
The New U.S. Fish and Wildlife Service (USFWS) Eagle Act Permit as a Conservation Tool.
- 2:00 pm **William G. Voelker**
Traditional Native American Culture in Conflict with Conservation, Public Perspective and the Law.
- 2:20 pm **Bryan D. Watts**
Eagle Economics: Estimating the Social Burden of Bald Eagle Recovery in the Lower Chesapeake Bay.
- 2:40 pm Bill Route and **Mark Martell**
Contaminants in Bald Eagle (*Haliaeetus leucocephalus*) Nestlings on the Mississippi and St. Croix Rivers.

3:00 – 3:40 pm *Coffee Break*



Thursday September 23 ♦ Conference Agenda

RAPTOR AND HUMAN-CONFLICTS SPECIAL SESSION (CONCURRENT SESSION)

Moderator: Brian Washburn

SALON D

- 3:40 pm **Karen Steenhof** and Michael N. Kochert
Effects of Off-Highway Recreational Vehicles on Nesting Golden Eagles (*Aquila chrysaetos*) in Southwestern Idaho.
- 4:00 pm **Brian E. Washburn**, Thomas J. Olexa, and Brian S. Dorr
Quantifying and Reducing Bird-Aircraft Strike Hazard (BASH) Risk Associated with Breeding and Migrating Osprey (*Pandion haliaetus*).
- 4:20 pm **Corinne J. Kendall**
Perspectives on the Interactions Between Old World Vultures and Human Societies
- 4:40 pm **Marian H. Gercken**, Martijn Egas, Jesus Aguirre, Michael Stubbe, and Ulrich Köppen
Occupation of a Vacant Nest Site by a Second-year Breeding Northern Goshawk (*Accipiter gentilis*)

CONCURRENT GENERAL SESSION II

Breeding Biology I

SALON E

Moderator: Jim Bednarz

- 10:00 am **Micah N. Scholer**, Matthias Leu, Lisa M. Nutt, and James R. Belthoff
Using Woodpeckers to Predict the Occurrence of Cavity Nesting Owls.
- 10:20 am **Reesa Yale Conrey**, Michael F. Antolin, and Lisa T. Savage
Rainfall and Introduced Plague Influence Breeding Success in a Non-Susceptible Dryland Species, the Burrowing Owl.
- 10:40 am **Scott J. Chiavacci** and James C. Bednarz
Nesting Success and Causes of Nesting Failures of the Mississippi Kite (*Ictinia mississippiensis*) in White River National Wildlife Refuge, Arkansas.
- 11:00 am **Susan R. Salafsky**, Richard T. Reynolds, and Barry R. Noon
The Influence of Prey Abundance and Weather on Northern Goshawk Reproduction in Arizona.
- 11:20 am **Romeo Tinajero**, Ricardo Rodriguez-Estrella, and Felipe Chavez-Ramirez
Effects of Habitat Fragmentation on the Breeding Ecology and Territory Size of Harris's Hawks in the Desert of Baja California Sur, México.
- 11:40 am Kathleen A. Townsend and **James C. Bednarz**
The Influence of Food Amount, Hatch Order, and Sexual Size Dimorphism on Sibling Aggression in Red-Shouldered Hawks.
- 12:00 – 1:40 pm *Lunch*



Thursday September 23 ♦ Conference Agenda

CONCURRENT GENERAL SESSION III

Breeding Biology II

SALON E

Moderator: James Dwyer

- 1:40 pm **Jessi L. Brown** and Michael W. Collopy
Sustained Rain Events and Selection on Timing of Reproduction in
Southeastern American Kestrels.
- 2:00 pm **Sean McCann**, Onour Moeri, Tanya Jones, Gerhard Gries, and Sean O'Donnell
Nesting and Provisioning Behavior of Red-throated Caracaras (*Ibycter*
americanus) in Central French Guiana.
- 2:20 pm **Ron A. Milgalter**, William P. Kuvlesky, Jr., Leonard Brennen, David G. Hewitt,
Eric J. Redecker, Dale Kane, Michael A. Actkinson, and Clint W. Boal.
Precipitation, Phenology, and Raptor Productivity: a Nest-Level Analysis for
White-tailed Hawks (*Buteo albicaudatus*) Breeding in South Texas.
- 2:40 pm **Julie A. Heath** and Karen Steenhof
Recruitment of Local, Second Year American Kestrels into the Breeding
Population: Who Comes Back and Why?

3:00 – 3:40 pm *Coffee Break*

CONCURRENT GENERAL SESSION IV

Breeding Biology III

SALON E

Moderator: Mike Kochert

- 3:40 pm **Michael Kochert** and Karen Steenhof
Use Frequency of Individual Nest by Golden Eagles in Southwestern Idaho:
Application to Management.
- 4:00 pm Raphaël Goulet, **David M. Bird**, and David Hancock
Aspects of the Ecology of Urban-nesting Bald Eagles (*Haliaeetus*
leucocephalus) in South-coastal British Columbia.
- 4:20 pm **Ross H. Crandall**, Bryan Bedrosian, and Derek Craighead
50-Year Golden Eagle Nesting Trends in South-Central Montana.
- 4:40 pm **John A. Smallwood** and Erica G. Mueller
Inherited Characteristics of the Vocalizations of American Kestrel (*Falco*
sparverius) Chicks: Variation Within and Among Broods.



Thursday September 23 ♦ Conference Agenda

POSTER SESSION 5:00 – 7:00 pm

WINDSOR ROOM

- Joseph G. Barnes**, Jef Jaeger, and Daniel Thompson
Habitat Use and Breeding Success of Peregrine Falcons (*Falco peregrinus*) in Lake Mead National Recreation Area.
- Shelley Bayard De Volo**, R. T. Reynolds, Sarah A. Sonsthagen, Sandra L. Talbot, and Michael F. Antolin
Phylogeography and population history of Northern Goshawks across North America.
- Matthew A. Boggie** and R. William Mannan
Movements of Adult Male Cooper's Hawks (*Accipiter cooperii*) During the Breeding and Non-breeding Season in an Urban Environment.
- Travis L. Booms**, Jackson S. Whitman, and Craig L. Gardner
Utility of Helicopters for Short-eared Owl (*Asio flammeus*) Nest Searches and Surveys.
- Mathieu R. Charette**, Sophie Calmé, Yol Reyes, and Fanie Pelletier
Multiple Uses of Roosts Sites in King Vulture (*Sarcorampus papa*).
- John Digiorgio**, Yoke B. Digiorgio, and Bryan D. Watts
Documentation of a Four-chick Bald Eagle Brood Fledged Along the Delaware River, Northampton County, Pennsylvania.
- R. A. Grove, **C. J. Henny**, J. L. Kaiser, B. L. Johnson, C. Furl, and R. J. Letcher
Ospreys and PBDEs from Columbia River Basin, USA, 2002-2009.
- Geoff Holroyd**
Status of Peregrine Falcon (*Falco peregrinus*) in Canada.
- Geoff Holroyd**, Helen Trefry, Enrique Valdez, and Jason Duxbury
Winter Destinations and Ecology of 'Canadian Burrowing Owls' (*Athene cunicularia*).
- Jean Lapointe**, Louis Imbeau, and Junior A. Tremblay
Home range of Female Peregrine Falcons (*Falco peregrinus anatum*) during the Breeding Season in Southern Quebec, Canada.
- Carrie M. E. Lambert**, Richard T. Reynolds, and Julie Savidge
Identifying Individual Northern Goshawks (*Accipiter gentilis*) Using Patterns on Molted Feathers.
- Jeffery S. Lambert**, Richard T. Reynolds, and Daniel Binkley
The 2006 Kaibab Plateau Warm Fire: Effects of Fire Severity on the Northern Goshawk (*Accipiter gentilis*).
- Jessica Crowley Larson** and Denver Holt
Investigations of the Breeding Ecology of the Northern Hawk Owl (*Surnia ulula*) In Western Montana.
- Celia Angelica Martinez Sarmiento** and Ricardo Rodriguez-Estrella
Seasonal Variation of Raptors at Oases of Baja California Sur, México.
- Michele J. McRae** and Beth A. Kaplin
The Effects of Severe Drought and Large Wildfire Incidents on the Golden Eagle Population in the Goshute Mountains of Northeastern Nevada.
- Ron A. Milgalter**, William P. Kuvlesky, Jr., Leonard Brennan, David G. Hewitt, Eric J. Redecker, Dale Kane, and Michael A. Actkinson
The Nesting Ecology of White-tailed Hawks (*Buteo albicaudatus*), Red-tailed Hawks (*Buteo jamaicensis*), and Crested Caracaras (*Caracara cheriway*) in South Texas.
- Brian A. Millsap** and Timothy F. Breen
Diet of Adult Cooper's Hawks (*Accipiter cooperii*) in North Florida, and Calculated Rates of Predation on Northern Bobwhite (*Colinus virginianus*).
- R. Wayne Nelson**, Geoffrey Holroyd, and Gordon Court
When Peregrines Fight: Territorial Advertisement and Defense Behavior.
- Kyle E. Pias**, and Wiley M. Kitchens
Home Range Composition and its Effects on Reproductive Success of Breeding Snail Kites (*Rostrhamus sociabilis plumbeus*) on the Kissimmee Chain of Lakes in Florida.



Thursday September 23 ♦ Conference Agenda

Lisa Takats Priestley

Guidelines for Owl Surveys in North America, an Update to the Nocturnal Guidelines Booklet.

Richard T. Reynolds, Carrie M. E. Lambert, Jeffery S. Lambert, Alison B. Cofer, John C. Seyfried, John D. Wiens, and Susan R. Salafsky

The Complex Relationship between Northern Goshawks (*Accipiter gentilis*) and Their Habitats on the Kaibab Plateau, Arizona.

Susan R. Salafsky, Barry R. Noon and Richard T. Reynolds

Evaluation of the Northern Goshawk as a Biodiversity Conservation Tool.

Ben R. Skipper and Clint W. Boal

Productivity and Nest Site Selection of Urban Mississippi Kites (*Ictinia mississippiensis*).

Dale W. Stahlecker

Plumage, Polygyny and Polyandry: An Unusual Nesting by an American Kestrel Female, Santa Fe, New Mexico, USA

Romeo Tinajero and Ricardo Rodriguez-Estrella

Albinism in Crested Caracara and other Raptors in Baja California Sur, México.

Elizabeth H. Urban and R. William Mannan

The Role of Oral pH in the Persistence of *Trichomonas gallinae* in Cooper's Hawks (*Accipiter cooperii*).

Elizabeth Wommack, Rauri C. K. Bowie, and Shawn Shirazi

Examination of Clinal Patterns of Black and White Tail Coloration for Male American Kestrels (*Falco sparverius*) Across the North American Continent.

SPECIAL PRESENTATIONS

SALONS D & E

Moderator: Dan Varland

7:00 - 7:30 pm **David H. Ellis**, Miguel D. Saggese, Isabel C. Caballero, R. Wayne Nelson, Ana Trejo, Susana Seijas, Facundo Barbar, and Agustin I. Guaglia.

The Pallid Color Morph of *Falco peregrinus cassini*: A History of Former Studies, a Summary of Recent Work, and Projections for Future Work

7:30 - 8:00 pm **Nick Dunlop**

Flocking Behavior of European Starlings Under Attack by Peregrine Falcons.

8:00 - 8:30 pm **Rob Palmer**

Bald Eagles Versus Starlings, and Other Local Raptors.



Friday September 24 ♦ Conference Agenda

Friday, September 24

8:00 – 8:40 am **Keynote Speaker Dr. Bruce McDonald**
Perspectives on Climate Change

SALONS D & E

CONCURRENT GENERAL SESSION V
Population Biology and Conservation

SALON E

Moderator: Clint Boal

- 8:40 am **Lisa M. Baril**, Douglas W. Smith, and Todd Koel
Declines in Bald Eagle (*Haliaeetus leucocephalus*) and Osprey (*Pandion haliaetus*) Reproductive Success in Yellowstone National Park: Are Declines in Cutthroat Trout (*Oncorhynchus clarki bouvieri*) since Exotic Lake Trout (*Salvelinus namaycush*) Introduction Responsible?
- 9:00 am Joel E. Pagel, **Lisa Baril**, and Douglas W. Smith
Peregrine Falcons (*Falco peregrinus*) in Yellowstone National Park: from Theodore Roosevelt to the Present Day.
- 9:20 am **Douglas W. Smith**, Joel E. Pagel, and Katy Duffy
The Yellowstone Raptor Initiative: An Open Call for Cooperators in the Shadow of Theodore Roosevelt.

9:40 – 10:00 am *Coffee Break*

THE ROLE OF BANDING IN RAPTOR CONSERVATION: PAST, PRESENT, AND FUTURE
(CONCURRENT SESSION)

SALON E

Moderator: Keith L. Bildstein

- 10:00 am **Danny Bystrak** and Elaine Nakash
Summary of Raptor Banding Records at the Bird Banding Lab.
- 10:20 am **Jo A. Lutmerding**, Matthew Rogosky, Elaine Nakash, Danny Bystrak, Bruce Peterjohn, and Jennifer McNicoll
Summary of Raptor Encounter Records at the Bird Banding Lab.
- 10:40 am Chris Farmer, Laurie Goodrich, David Barber, and **Keith L. Bildstein**.
Raptor Banding and the Migration Geography and Ecology of Raptors.
- 11:00 am **Jennifer L. McNicoll**, Bruce G. Peterjohn, Elaine Nakash, Joanna Lutmerding, and Danny Bystrak.
Changes in the Reasons Why People Have Reported Raptor Encounters to the BBL Over the Decades.
- 11:20 am **Angus C. Hull**, Joshua M. Hull, Jill A. Harley, John J. Keane, Judd A. Howell, and Allen M. Fish
25 Years of Raptor Banding at the Marin Headlands: a Review of Collaborations.
- 11:40 am David L. Evans, **Gerald J. Niemi**, and Matthew A. Etterson.
A 38-year Summary of Raptor Banding at Hawk Ridge, Duluth, Minnesota, USA.

12:00 – 1:40 pm *Lunch*



Friday September 24 ♦ Conference Agenda

THE ROLE OF BANDING IN RAPTOR CONSERVATION: PAST, PRESENT, AND FUTURE
(CONCURRENT SESSION) **SALON E**

Moderator: Keith L. Bildstein

- 1:40 pm William S. Clark and **Olin S. Allen**
The Cape May Raptor Banding Project: 40 Years of Conservation through Banding.
- 2:00 pm Shawn E. Hawks, **Steve Slater**, and Jeff P. Smith
A Spatial Temporal Assessment from Three Decades of Raptor Banding throughout the American West.
- 2:20 pm **Daniel E. Varland**, Joseph B. Buchanan, Tracy L. Fleming, Mary Kay Kenny, and Thomas M. Loughlin.
Peregrine Falcons on Coastal Beaches of Washington: Banding and Surveys 1995-2010.
- 2:40 pm **Carol L. McIntyre**
Comparing Sources of Mortality and Extent of the Wintering Range of Migratory Juvenile Golden Eagles (*Aquila chrysaetos*) from interior Alaska as Derived from Banding and Satellite Telemetry Data.

3:20 – 3:40 pm *Coffee Break*

THE ROLE OF BANDING IN RAPTOR CONSERVATION: PAST, PRESENT, AND FUTURE
(CONCURRENT SESSION) **SALON E**

Moderator: Bruce Peterjohn

- 3:40 pm Bryan D. Watts and **Elizabeth K. Mojica**
Use of GPS-Satellite Transmitters to Inform Management of Bald Eagle Roosts within the Upper Chesapeake Bay, USA.
- 4:00 pm **Corinne J. Kendall**
Have You Ever Gotten a Text Message from a Vulture?: Using GSM-GPS Transmitters to Assess Movement, Habitat Use, and Mortality in African vultures.
- 4:20 pm **Michael Wallace**
Patagial Tag/Transmitters for Condors and Other Large Vultures.
- 4:40 pm **Scott Weidensaul**
Geolocators and Raptors: Advantages and Limitations of a New Tracking Technology.
- 5:00 pm Keith L. Bildstein and **Bruce G. Peterjohn**
The Future of Raptor Banding.

RAPTORS AND ZOO NOTIC INFECTIONS SPECIAL SESSION (CONCURRENT SESSION)
SALON D

Moderator: Nick Komar

- 8:40 am **Nicole M. Nemeth**
West Nile Virus in Raptors.
- 9:00 am **William M. Iko**, Robert J. Dusek, and Erik K. Hofmeister
Occurrence of West Nile Virus Infection in Raptors at the Salton Sea, California.
- 9:20 am **Alan B. Franklin** and Robert G. McLean
West Nile Virus and Spotted Owls (*Strix occidentalis*): Threat or Fallacy?

9:40 – 10:00 am *Coffee Break*



Friday September 24 ♦ Conference Agenda

RAPTORS AND ZONOTIC INFECTIONS SPECIAL SESSION (CONCURRENT SESSION)

SALON D

Moderator: Nick Komar

- 10:00 am Adrian L. Diaz, Marta S. Contigiani, J. M Vanella, Agustin I. Quaglia, Hernan Argibay, and **Miguel D. Saggese**
Prevalence of West Nile virus and Saint Louis encephalitis virus antibodies in Argentine birds of prey
- 10:20 am J. P. Dubey, **T. A. Felix**, and Och Kwok
Serological and Parasitological Prevalence of *Toxoplasma gondii* in Colorado Raptors.
- 10:40 am **Nicole M. Nemeth**
Avian Influenza Viruses in Raptors.

11:00 – 11:20 am *Panel Discussion: Raptors and Zoonotic Infections*

CONCURRENT GENERAL SESSION VI

Applications of Genetic Techniques

SALON D

Moderator: Nick Komar

- 11:20 am **Isabel C. Caballero**, Mary V. Ashley, John M. Bates, Doug Bell, Joel E. Pagel, and Clifford M. Anderson
Genetic Patterns of Recovered Western and Midwestern Peregrine Falcons (*Falco peregrinus*).
- 11:40 am **Fiona E. Hogan**, and Raylene Cooke
Insights into the Breeding Behavior and Dispersal of the Powerful Owl (*Ninox strenua*) Determined through the Collection of Shed Feathers.

12:00 – 1:40 pm *Lunch*

CONCURRENT GENERAL SESSION VII

Conservation I

SALON D

Moderator: Torgeir Nygård

- 1:40 pm **Brandon M. Breen**, Keith L. Bildstein, Francesca J. Cuthbert, and Kristen C. Nelson
Sheep Farmers and Turkey Vultures (*Cathartes aura*) in the Falkland Islands: From Conflict to Coexistence.
- 2:00 pm **Bryan Bedrosian**
Eagles and Lead Rifle Ammunition: Where We're at, Challenges, and Solutions.
- 2:20 pm **Geoff Holroyd**, Héctor E. Valdez-Gómez, and Helen Trefry
The Clarion Burrowing Owl (*Athene cunicularia rostrata*), a Forgotten Subspecies.
- 2:40 pm **Torgeir Nygård**, Duncan Halley, and Allan Mee
The Reintroduction of the White-tailed Eagle (*Haliaeetus albicilla*) to Ireland.
- 3:00 pm **John H. Barclay**, Nicole M. Korfanta, and Matthew J. Kauffman
Long-term Population Dynamics of a Managed Burrowing Owl Colony.

3:20 – 3:40 pm *Coffee Break*



Friday September 24 ♦ Conference Agenda

CONCURRENT GENERAL SESSION VIII

Conservation II

SALON D

Moderator: David Bird

- 3:40 pm **Daniel N. Gossett**
Raptor Research: Where We Started, Where We Have Been, Where Should We Go?
- 4:00 pm Shelly C. Buranek, William I. Boarman, Amy L. Fesnock, and **Douglas A. Bell**
Radio-tracking Prairie Falcons (*Falco mexicanus*) Breeding at the Pinnacles National Monument to Characterize Habitat Selection, Identify Key Falcon-use Areas and Assess Anthropogenic Threats at the Landscape Level.
- 4:20 pm **James R. Klucsarits**, Joshua J. Rusbuldt, and Keith L. Bildstein.
A Population Update of American Kestrels (*Falco sparverius*) in Eastern Pennsylvania (2006-2010): Trends in Nest Box Use and Productivity.
- 4:40 pm **David M. Bird**
Can We Reverse the Decline in American Kestrel Populations?
- 5:00 pm **Helen A. Snyder**
A World Class Raptor Area in Arizona: A Comparison of Raptor Breeding Density and Diversity between Cave Creek Canyon on the Coronado National Forest and the Bureau of Land Management's Morley Nelson Snake River Birds of Prey National Conservation Area in Idaho



Saturday September 25 ♦ Conference Agenda

Saturday, September 25

RAPTORS IN EDUCATION SYMPOSIUM (CONCURRENT SESSION)

SALON E

Moderator: Kate Davis

- 8:20 am **Katharine E. Duffy**
 Instilling an Appreciation of Raptors without the Use of Captive Birds.
 Gretchen Albrecht (*Cancelled*)
 Out of a Rut- New Staff, New Birds, New Message, New Program!
- 8:40 am **Kate Davis**
 Raptors in the Creative Process.
- 9:00 am Gail Kratz, Jeff Stark, and **Judy Scherpelz**
 Creativity and Flexibility in Cage Design for Rehabilitating Raptors.
- 9:20 am **William G. Voelker**
 Introducing Sia: The Comanche Nation Ethno-Ornithological Initiative.

9:40 – 10:00 am *Coffee Break*

RAPTORS IN EDUCATION SYMPOSIUM (CONCURRENT SESSION)

SALON E

Moderator: Kate Davis

- 10:00 am **Kit Lacy**, Louise A. Shimmel, and Laurin Huse
 Raptors' Role in Age-Appropriate Education.
- 10:20 am **John E. Parks** and Beau E. Parks
 The Cornell Raptor Program – An Approach to Educating Tomorrow's Raptor Educators.
- 10:40 am **F. Scott McCorkle** and Carol V. McCorkle
 Uses of Falconry Training in Rehabilitating Raptors for Release or Education.
- 11:00 am **James Dawson** and **Larisa Thomas**
 Extended Free Flight: A Different Avian Demonstration Approach.
- 11:20 am **Walter Crawford**
 The Changing Face of Raptor Education.

12:00 – 1:40 pm *Lunch*

RAPTORS IN EDUCATION SYMPOSIUM (CONCURRENT SESSION)

SALON E

Moderator: Kate Davis

- 1:40 pm **Eliza Savage**
 Federal Migratory Bird Educational Use Permit Regulations.
- 2:00 pm **Glenn R. Stewart**
 Research Based Conservation Education Using Iconic Species of Wildlife.
- 2:20 pm Jennifer Hajj and **Steve Slater**
 This Hawk Can Teach Statistics: Using Migration Monitoring as a Theme for Curriculum Development.
- 2:40 pm **Dianne Moller**
 Women and Raptors in the 21st Century.



Saturday September 25 ♦ Conference Agenda

3:00 pm **Jemima Parry-Jones**
The International Centre for Birds of Prey, its History, its Future, its
Educational Values and its Ethics.

3:20 – 3:40 pm *Coffee Break*

3:40 – 5:00 pm *Business Meeting*

SALON E

RAPTORS AND ENERGY DEVELOPMENT SPECIAL SESSION (CONCURRENT SESSION)

SALON D

Moderator: Rick Harness

8:00 am **Gwyn McKee**
Long-term Trends for Nesting Raptors and Prey Populations Relative to the
Effects of Surface Coal Mining on Nesting Raptors in Northeast Wyoming.

8:20 am **Steven J. Slater**, Jeff P. Smith, and Mike C. Neal
A Retrospective Assessment of the Effects of Oil and Gas Field Activities on
Nesting Raptors near Price, Utah and Rawlins, Wyoming.

8:40 am **Nicholas M. Morgan**
Tolerances of Raptors to Blasting and Construction Activity on the
Susquehanna River during the Development of the Holtwood Hydroelectric
Expansion.

9:00 am **Cindy M. Kemper and Nikki S. Heck**
Raptor Nest Management Programs at Two Canadian Electrical Utilities.

9:20 am **Joey Mason**
Methane Burners: Better Management Practices in the Making.

9:40 – 10:00 am *Coffee Break*

RAPTORS AND ENERGY DEVELOPMENT SPECIAL SESSION (CONCURRENT SESSION)

SALON D

Moderator: Rick Harness

10:00 am **Jon Smallie** and Luke Strugnell
Use of Camera Traps to Investigate Cape Vulture (*Gyps coprotheres*)
Roosting Behavior on Power Lines in South Africa.

10:20 am **Von R. Pope**, Thomas A. Hamer, and Jake Verschuyt
Pre- and Post-Construction Evaluation of Collision Potential for Fall Migrating
Raptors with a Transmission Line in Central Washington.

10:40 am **Robert N. Lehman** and Richard E. Harness
Estimating Raptor Electrocution Rates and Interpreting Mortality Data.

11:00 am **P. R. Juvvadi**
Bird Electrocutions on High Tension Distribution Power Lines in Andhra
Pradesh, India - Species Recorded, Modes of Electrocution and Pole
Configurations.

11:20 am **Richard E. Harness**
Electrocution Assessment of Power Lines Serving a Wyoming Oil and Gas
Field.

11:40 am **Albert M. Manville, II**
Steps to Avoid or Minimize Take and Disturbance of Raptors at Power Lines
and Commercial Wind Turbines.

12:00 – 1:40 pm *Lunch*



Saturday September 25 ♦ Conference Agenda

RAPTORS AND ENERGY DEVELOPMENT SPECIAL SESSION (CONCURRENT SESSION)
SALON D

Moderator: Rick Harness

- 1:40 pm **Camina Alvaro**
The Windfarm Development in Spain: Impact and Correction Measures on Raptor Species.
- 2:00 pm **Charles Maisonneuve**, Junior A. Tremblay, Todd Katzner, Tricia Miller, Michael Lanzone, and David Brandes
Influence of Landscape Configuration on Wind Farm Frequentation by Golden Eagles (*Aquila chrysaetos*) – A Case Study.
- 2:20 pm **Scott G. Cole** and Espen Lie Dahl
Ex Post Compensation for White-Tailed Eagle (*Haliaeetus albicilla*) Impacts at the Smøla Wind Farm: An Application of Equivalency Analysis.
- 2:40 pm **Patricia Y. Sweanor**
Best Management Practices for Wind Energy in Areas with Golden Eagles (*Aquila chrysaetos*) in Wyoming.
- 3:00 pm **Diana M. Whittington**, Joel E. Pagel, Robert Murphy, and Eric L. Kershner
Long-term Strategies and Information Needs for Conserving Golden Eagles (*Aquila chrysaetos*) and Bald Eagles (*Haliaeetus leucocephalus*) in an Energy Development Environment.

3:20 – 3:40 pm *Coffee Break*

3:40 – 5:00 pm *Business Meeting*

SALON E

CONCURRENT GENERAL SESSION IX
Movements and Spatial Ecology

SALONS F-H

Moderator: Travis Booms

- 8:00 am **Mark Martell** and Scott Mehus
Migratory Route of Two Golden Eagles between Southwestern Wisconsin and Northern Canada.
- 8:20 am James Johnson, **Travis L. Booms**, Steven Matsuoka, and Lucas Decicco
Migration Routes and Wintering Areas of Short-eared Owls (*Asio flammeus*) Tagged in Nome, Alaska.
- 8:40 am Sean R. Beckett, **Glenn A. Proudfoot**, and Mary Ann Cunningham
Large-scale Movement and Migration of Northern Saw-whet Owls (*Aegolius acadicus*).
- 9:00 am **Ron A. Milgalter**, William P. Kuvlesky, Jr., Leonard Brennan, David G. Hewitt, Eric J. Redeker, Dale Kane, Michael A. Actkinson, and Clint Boal
Spatial and Temporal Characteristics of Territories of Three Sympatric Raptors in South Texas.
- 9:20 am **J. David Wiens**, Robert G. Anthony, and Eric D. Forsman.
Spatial Ecology of Northern Spotted Owls and Barred Owls in Western Oregon.

9:40 – 10:00 am *Coffee Break*



Saturday September 25 ♦ Conference Agenda

CONCURRENT GENERAL SESSION X
Ecology, Ecotoxicology, and Diseases

SALONS F-H

Moderator: Miguel Saggese

- 10:00 am **Edward H. R. Moss**, Tim Hipkiss, Frauke Ecke, Per Sandström, Mats Nilsson, Thomas Birkö, P.-O. Nilsson, and Birger Hörnfeldt
Habitat Properties of High and Low Quality Golden Eagle (*Aquila chrysaetos*) Territories.
- 10:20 am Adam C. Behney, **Clint W. Boal**, Heather A. Whitlaw, and Duane R. Lucia
Predator-Prey Relationship of Raptors and Lesser Prairie-chickens in West Texas.
- 10:40 am Erica H. Craig, **Heather R. Craig**, Matthew J. Wooller, and Tim H. Craig
Use of Carbon and Nitrogen Stable Isotope Signatures to Investigate Dietary Patterns in Wintering Golden Eagles (*Aquila chrysaetos*).
- 11:00 am **Cheryl R. Dykstra**, William T. Route, Michael W. Meyer, Paul W. Rasmussen, and Rebecca Key
Mercury, DDE, and PCB Trends in Bald Eagle Nestlings in the Upper Midwest.
- 11:20 am **Sofi R. Hindmarch** and John Elliott
Investigating the Potential Risk of Secondary Rodenticide Poisoning to Barn Owls (*Tyto alba*) Inhabiting and Foraging in Urban Landscapes of the Lower Mainland, British Columbia.
- 11:40 am **Miguel D. Saggese** and Agustin I. Quaglia
Health Assessment of Birds of Prey (Aves, Falconiformes, Strigiformes) in Argentina: An Overview of Recent Advances and Future Challenges.



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Long-Term Population Dynamics of a Managed Burrowing Owl Colony

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We analyzed population dynamics of a Burrowing Owl (*Athene cunicularia*) colony at San Jose International Airport in San Jose, California from 1990-2007. The breeding colony increased from 7 pairs in 1991 to 40 pairs in 2002 and declined to 17 pairs in 2007. Annual nesting success (pairs with ≥ 1 young) averaged 79% (SE = 0.04) and ranged from 36–100%. Fecundity averaged 3.36 juveniles/pair (SE = 0.23) and ranged from 1.43-4.54 juveniles/pair. Average nesting success of pairs in artificial burrows (87%, SE = 0.03) was not significantly different from pairs in natural burrows (76%, SE = 0.04) (t test; $P = 0.07$). Fecundity of pairs in artificial and natural burrows was not comparable because nestlings in artificial burrows were counted whereas nestlings in natural burrows were estimated from above-ground counts. Annual survival rates during 1996-2007 were estimated at 0.545 (SE = 0.033) for adults and 0.258 (SE = 0.024) for juveniles using program MARK. Adult survival was estimated at 0.710 (SE = 0.055) during colony increase from 1996-2002 and 0.465 (SE = 0.040) during decline from 2002-2007. The colony increased by an average of 4.8% per year ($\lambda = 1.048$) and annual change was not significantly correlated with reproduction the previous year (juveniles per pair; $R^2 = 0.017$, $P = 0.61$). Growth rates estimated from average vital rates were $\lambda_a = 1.072$ with $\lambda_j = 1.288$ during colony increase and $\lambda_d = 0.921$ ($\Delta\lambda = 0.368$) during decline. A life table response experiment showed that

changes in adult survival rates explained more than twice the variation in λ than other vital rate changes during the increasing and declining periods. We found no correlation between aircraft bird strike reports identifying owls (including Barn Owls [*Tyto alba*]) and the Burrowing Owl population (i.e., adults and juveniles; Pearson correlation = 0.185; $P = 0.477$).

Declines in Bald Eagle (*Haliaeetus leucocephalus*) and Osprey (*Pandion haliaetus*) Reproductive Success in Yellowstone National Park: Are Declines in Cutthroat Trout (*Oncorhynchus clarki bouvieri*) since Exotic Lake Trout (*Salvelinus namaycush*) Introduction Responsible?

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In Yellowstone National Park (YNP) the introduction of predatory lake trout to Yellowstone Lake has resulted in dramatic declines in native Yellowstone cutthroat trout raising concerns regarding ecosystem structure and function in the region. Over 50% of YNP's breeding pairs of Bald Eagles and Ospreys nest and forage along the shores of Yellowstone Lake and connected tributaries with the remaining population breeding elsewhere in YNP. We used 24 yrs of data to compare nest attempts, nest success, and productivity for Bald Eagles and Ospreys nesting in the lake trout influenced population of Yellowstone Lake to the non-lake trout influenced population of YNP where cutthroat trout abundance is stable and attempted to determine if variation in cutthroat trout was associated with measures of reproduction for both populations. Preliminary analyses showed that all three Bald Eagle reproductive measures increased over the 23-yr period for the non-lake population, but that only nest attempts increased for the lake population while productivity and success both declined. Ospreys exhibited dramatic declines in all three reproductive measures in both populations, but declines were more



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acute in the lake population particularly in recent years. There was no association between cutthroat trout availability and nest attempts or productivity for either species in both populations, but nest success was significantly associated with cutthroat trout declines for the both Osprey populations and the Bald Eagle lake population. These results suggest that the declining cutthroat trout population is at least partially responsible for declines in reproduction for the lake population for both species, but that other factors may also be associated with declines in reproduction, particularly for the non-lake Osprey population and requires further study.

Call-Broadcast Surveys as an Effective Tool for Detecting Breeding Peregrine Falcons (*Falco peregrinus*)

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We developed a call-broadcast survey protocol for assessing Peregrine Falcon breeding site occupancy within Lake Mead National Recreation Area in southern Nevada and northwest Arizona. We performed 10 min call-broadcast sessions, consisting of three observation periods separated by two 30 sec broadcast periods of conspecific “cack” and “eechup” vocalizations. During 2008 and 2009, we conducted method testing at up to 28 known breeding territories during each of the primary stages of the breeding season (i.e., courtship, incubation, nestling, and fledgling). We also conducted an additional round of testing at 24 sites in 2009 during the non-breeding season. When at least one adult was confirmed present at each site prior to broadcasting, response rates were highest during the courtship (97%) and incubation (81%) stages, followed by the nestling (60%), fledgling (70%) and post-breeding (50%) stages. We conducted surveys in 2009 as blind runs at active

territories but where Peregrine presence was not first confirmed the day of broadcasting. After two rounds of these surveys, detection rates were 89% during courtship, 93% during incubation, and 89% during nestling stages. Detection rates were 71% and 42% after a single round of surveys in the fledgling and non-breeding stages. We found call-broadcast to be most effective during the breeding season at distances up to 600 m from eyries, and over 98% of detections occurred within 5 min of broadcasting. In 2009, we combined call-broadcast with a simplified predictive habitat suitability model to conduct targeted rapid assessments at 111 potential sites. Using this approach, we confirmed 10 previously undocumented territories. Our assessments indicate that call-broadcast is an effective and efficient tool to determine Peregrine occupancy, which should be used primarily during the early breeding stages when response rates are highest and before early breeding failures might occur.

Large-scale Movement and Migration of Northern Saw-whet Owls (*Aegolius acadicus*)

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We use information compiled by the USGS Bird Banding Laboratory and geographic information systems analysis to identify trends in annual movement of Northern Saw-whet Owls across eastern North America. We examine timing, directionality, and speed of fall migration, as well as age- and sex-differentiated migration patterns. We use DNA analysis to evaluate the sex of 352 saw-whet owls caught in Ulster County, New York, and use this information to assess the accuracy of the morphometric methods currently used to assign sex to saw-whet owls. Analysis reveals a clear north-to-south annual fall migration with peaks in migration activity occurring progressively later in the season as latitude decreases, confirming what earlier studies have observed at smaller scales. Males



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were encountered disproportionately farther north than females, and juveniles were encountered farther south than adults, showing that age- and sex-differentiated migration patterns may exist in this species. Results suggest that individual saw-whet owls may maintain a high level of migration route fidelity between years. Finally, we find that the current sexing protocol may disproportionately assign males, limiting the ability of researchers to identify sex-differentiated patterns using morphometrics alone. These findings illustrate the versatility of collective datasets as a tool for answering large-scale questions regarding migration ecology and life history.

Eagles and Lead Rifle Ammunition: Where We're at, Challenges, and Solutions

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Birds have long been recognized to be at risk of lead poisoning from ammunition sources, but only in recent years has rifle ammunition been identified as a source of lead toxicity in raptors and other scavenging birds. Several studies have indicated increased lead exposure in eagles but the implications to population dynamics remain unclear. Mortality from lead rifle ammunition has been well documented in White-tailed Eagles (*Haliaeetus albicilla*) and Steller's Sea Eagle (*H. pelagicus*) while Bald Eagle (*H. leucocephalus*) mortalities have been linked to various sources of lead in the environment. Although Steller's Sea Eagle populations have been negatively affected by lead-based rifle ammunition, convincing managers and the hunting community that lead-based ammunition negatively affects eagle populations in the USA remains a challenge since Bald Eagle populations are expanding. Further, studies indicate Bald Eagles can be tolerant of extremely high blood lead levels and Golden Eagles (*Aquila chrysaetos*) are rarely documented with high lead levels. However, due to the migratory nature of eagles and large tracks of land not monitored, potential effects in many areas may not be documented. Also,

the cumulative nature and unknown sub-lethal effects of lead ingestion in birds may alter stages of life-history that are difficult to monitor. To account for those unknowns as well as the protection of species sensitive to lead-caused mortality such as the California Condor (*Gymnogyps californianus*), lead rifle ammunition must be removed from all ecosystems. Several programs have been implemented at the state level with varying success. A large-scale, coordinated effort between the scientific community, land managers, and the hunting public is needed to reduce the risk of lead poisoning for all scavenging birds as well as data collection. I will discuss potential solutions and challenges of implementing non-lead programs and highlight research needs to adequately address this issue.

Predator-Prey Relationship of Raptors and Lesser Prairie-chickens in West Texas

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Predation may have disproportionate influences on a prey species as that species occurs in smaller, more fragmented populations across its distribution. Lesser Prairie-chickens (*Tympanuchus pallidicinctus*) are a lekking species and candidate for federal protection due to population declines throughout their distribution. We examined the relationship of raptors and Lesser Prairie-chickens by examining interactions at leks and assessing prey deliveries to raptor nests. We used video recording systems and direct observations to monitor interactions of raptors and leks for 650 hrs while prairie-chickens were present. We also used video recording systems to monitor prey deliveries to five Swainson's Hawk (*Buteo swainsoni*) nests in our study area. Northern Harriers (*Circus cyaneus*) and Swainson's Hawks were the most common raptors observed at



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leks. Of 61 raptor encounters at leks (0.09/hr) only 24% resulted in a capture attempt (0.02/hr). Mean time for prairie-chickens to return to lekking behavior following a raptor encounter was 4.2 ± 5.5 (SD) min, suggesting raptor disturbance had little influence on lekking. Additionally, prairie-chickens engaged in different escape behaviors depending on the raptor species, suggesting they are able to assess different predation risks. No prairie-chickens were among 266 identifiable prey delivered to Swainson's Hawk nests. Raptors appear to pose little predation risk to lekking Lesser Prairie-chickens in our study area and behavioral disturbance appears minimal. During the breeding season, Swainson's Hawks are the major diurnal raptors in our study area, but appear to pose little or no population level threat to Lesser Prairie-Chickens. However, our results are limited to the region of our study in the Southern High Plains.

Can We Reverse the Decline in American Kestrel Populations?

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According to the December 2009 issue of The Journal of Raptor Research, that American kestrels (*Falco sparverius*) have definitely undergone a decline in some regions of North America seems hard to dispute. However, this begs two questions. First, will the slide in kestrel numbers continue to the point of endangerment or is it just a blip in history? Second, what is behind the decline? There is no shortage of interesting hypotheses for the cause of the decline, and by no means mutually exclusive. Predation pressure from accipiters, nest-cavity competition with starlings, and exposure to pollutants are cited as possible causes. One certainly cannot rule out the impact of widespread changes in habitats and/or invertebrate prey availability due to global warming or some other phenomenon. There is a need to ascertain beyond any doubt that the species

is declining, the causes behind it, and most important, what can be done about it.

Sheep Farmers and Turkey Vultures (*Cathartes aura*) in the Falkland Islands: from Conflict to Coexistence

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Human-wildlife conflict is a growing threat to natural-resource conservation. We investigate this with the goal of mitigating a conflict involving sheep farmers, conservationists, and Turkey Vultures in the Falkland Islands. We interviewed half of the farmers, collected questionnaires from half of the farmers and nearly all conservationists, observed vulture-sheep interactions on five farms for 184 hours during the lambing period in 2008 and used these data to model vulture damage. Farmers wish to prevent vulture damage on sheep, primarily birthing ewes, lambs, and cast sheep (i.e., those that fall down and are unable to get up). Our results indicate vulture damage on sheep is low (<<1% per year) on nearly every farm on the islands. A single farmer gave one first-hand account of a vulture preying on a lamb. During our field observations we did not observe vultures attacking or harassing sheep or lambs, although vulture(s) were seen feeding on live and cast ewes twice. About half of farmers are not satisfied with current government regulation of vulture control (i.e. application required for permit to cull up to 20 vultures per farm per year), a third of all farmers expressed a willingness to illegally kill vultures, farmer tolerance of vulture damage is low, and most farmers believe shooting is the only vulture control option. We see potential to mitigate this conflict through a government policy that authorizes



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limited selective control of vultures for all farmers, together with improved animal husbandry and farmer-education interventions. Our findings suggest a path to mitigation for this and potentially other human-wildlife conflicts.

Apparent Nest Success Versus Daily Nest Survival: a Case Study of Swainson's Hawks

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Apparent nest success has long been known to be a poor estimator of true nest success within a population due to the inherent bias of not being able to locate failed nests. More and more sophisticated statistical tools are being developed to address issues of bias and pseudoreplication in nest success. However, in larger species it is sometimes possible to detect nests even after failure, perhaps allowing more accurate estimates of apparent nest success. Failed nests are often apparent due to down, feathers, egg shell and nest construction. This information is not readily incorporated into the current statistical frameworks. We used five years of nesting data from a population of Swainson's Hawks (*Buteo swainsoni*) to: 1. Compare daily nest survival models with apparent nest success, and 2. Determine if there were differences in model selection or effect sizes of covariates of nest success. We used a hierarchical Bayesian daily nest survival model to examine seasonal nest survival and account for bias in not being able to detect failed nests and compared this value with crude nest success where we included nests found after failure. Our analysis demonstrated wide agreement between annual nest success between the Bayesian analysis (63.7±3%) and apparent nest success (61.8%). Next we used several covariates in each analysis: primary productivity, distance and amount of

agriculture within a territory, and tree density around the nest site. To examine correlates of apparent nest success we used a mixed effects logistic regression. Generally, there was agreement between model selection between the Bayesian and regression methods, and the overall effects of the variables agreed between the methods. In this situation, apparent nest success may be used as a surrogate of true nest success. The long-term nature of the study, coupled with the conspicuous nature of Swainson's Hawks and their nest structures, allowed us to locate many nests even after failure reducing detection bias. However, we emphasize that this situation may be rare in avian studies and all researchers should first determine if using apparent nest success is appropriate in their situation.

Sustained Rain Events and Selection on Timing of Reproduction in Southeastern American Kestrels

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The Southeastern American Kestrel (*Falco sparverius paulus*) might be expected to show little seasonality in its reproductive cycle because of the relatively mild climate throughout its range and its non-migratory life history. However, although many southeastern kestrels nest earlier than their northern relatives, their latest nesting attempts are initiated no later than those of other subspecies. This occurs despite continued apparent presence of prey throughout the summer. Weather is another possible driver of seasonality in reproductive behavior. We observed the effects of an unusual sustained rain event on kestrel nesting success. During 18-20 May 2009, storms stalled over our north-central Florida study sites and delivered nearly continuous precipitation. This event was very unusual because consecutive days of precipitation occur primarily during the rainy season (June through November) in the southeast US. We compared models of daily nest



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survival rates (DSR) of 128 kestrel nesting attempts during May 2009 and 2008 (a more typical precipitation year) in program MARK. Using an information-theoretic approach, we found that DSR was best described by the daily number of hours of rain and the age of the nesting attempt. Maximum daily temperature could also describe nest survival well, with higher survival associated with higher temperatures, but the effect of rainfall was stronger. Survival rates were lowest for nests containing young nestlings, and highest for those containing eggs or nestlings near fledging. We hypothesize that the near-continuous rain greatly reduced the efficiency of the parents' foraging attempts, and that rapidly growing young nestlings were most vulnerable to starvation and/or hypothermia. The typical occurrence of such weather in summer and fall may contribute strongly to selection for spring reproduction in the Southeastern American Kestrel.

Radio-tracking Prairie Falcons (*Falco mexicanus*) Breeding at the Pinnacles National Monument to Characterize Habitat Selection, Identify Key Falcon-use Areas and Assess Anthropogenic Threats at the Landscape Level

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Increasing urbanization, intensive renewable energy development and changing agricultural practices typify human-related pressures on the California landscape. The Pinnacles National Monument (PINN) provides protected nesting habitat for up to 11 pairs of Prairie falcons. Although little information was known about where the PINN's resident population of Prairie falcons foraged, we hypothesized that they used a mosaic of land types in non-preserved areas surrounding PINN. In order to identify land-use by Prairie falcons nesting at PINN, we radio-tracked 17 nesting falcons (9 males,

8 females) from March 2002 to December 2004. Relocations per falcon averaged 97.8 (range: 5-35). Home range based on 100% MCP averaged 187 km² (sd = 188 km²). We used ArcGIS® to measure landscape parameters. Of 1306 falcon relocations, 44% were in grassland. Grassland in California represents one of the state's most threatened habitat types due to increasing anthropogenic influences. With sexes pooled, chi-square analysis with 95% Bonferroni confidence intervals revealed scrublands and floodplain were used more than expected. With sexes separate, females used grasslands (98.86, df = 13, $P < 0.0001$) and males used agricultural and scrub lands (66.5485, df = 8, $P < 0.0001$) more than expected. Grassland, slope, elevation and distance to nest were important parameters for falcon locations as determined by logistic regression. Type of habitat use also varied between individual falcons. Of particular interest, over 99.4% of all falcon locations were west of PINN, in Monterey County, even though apparently suitable habitat in San Benito County exists east of PINN. Prairie falcons breeding at PINN are year-round residents. We identified nine geographically distinct core falcon-use areas outside of PINN that appear to be vital to sustaining breeding Prairie falcons at PINN.

Genetic Patterns of Recovered Western and Midwestern Peregrine Falcons (*Falco peregrinus*)

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Peregrine Falcon populations across the US abruptly declined in the 1950s due to the bioaccumulation of chlorinated hydrocarbon



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insecticides. Specifically, Western US populations declined drastically while Midwestern populations were extirpated. Successful reintroduction projects were launched in 1980s using three different regional approaches. In the Midwest, birds representing several subspecies and genetic origins were used as founding stocks. In southern California, intense management beginning with two wild pairs was undertaken. In northern California, Oregon, and Western Washington remnant populations recovered on their own. These different reintroduction strategies might result in different patterns of genetic recovery. To test these differences we analyzed a total of 150 samples representing the three recovered populations using two mitochondrial DNA gene sequences and 11 polymorphic microsatellite loci. Surprisingly, all three populations showed similarly high levels of mitochondrial DNA and microsatellite diversity. The mean microsatellite gene diversity values are 0.66 ± 0.22 for the two Western populations and 0.71 ± 0.18 for the Midwestern population. A total of 15 mitochondrial DNA haplotypes were present in the recovered populations. There is little genetic differentiation among the three populations, although they are derived from different subspecies and regions. This study provides a first insight into the genetic outcomes resulted from the different recovery strategies.

Nesting Success and Causes of Nesting Failures of the Mississippi Kite (*Ictinia mississippiensis*) in White River National Wildlife Refuge, Arkansas

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Previous studies on the nesting ecology of the Mississippi Kite in the Mississippi Alluvial Valley have reported relatively lower nest success rates compared with kites breeding in other regions of the United States. However, little has been done to determine what factors could be contributing to the poor nest success rates consistently

documented in the region. We studied nesting Mississippi Kites in the White River National Wildlife Refuge, Arkansas and monitored nests with time-lapse video recording systems to document causes of nesting failures. We located 41 kite nests during 2008 and 2009, nine of which successfully fledged one nestling each. Seventeen nests were monitored with video recording systems, totaling 628 nest days of video data. We documented eight events that led to nest failure; three failures were non-predator related, three were due to black rat snakes (*Elaphe obsoleta*), one was due to a Barred Owl (*Strix varia*), and one was due to a Great Horned Owl (*Bubo virginianus*). We modeled the daily survival probability of nests using the logistic-exposure method and evaluated numerous models using an information theoretic approach and Akaike's Information Criterion. We developed a set of *a priori* models based on temporal/biological and habitat variables. The estimated overall probability of nest survival was 25%, while stage-specific (incubation and brood-rearing stages) survival was variable both within and across years. No temporal/biological factors investigated were effective predictors of nest survival, resulting in the constant survival (null) model being the best predictor of success. These results suggest that nest failures of Mississippi Kites in the White River National Wildlife Refuge are largely random processes.

Rainfall and Introduced Plague Influence Breeding Success in a Non-Susceptible Dryland Species, the Burrowing Owl

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Introduced pathogens such as plague caused by *Yersinia pestis* can have far-reaching effects on native ecosystems that go beyond the mortality of infected individuals. We investigated the effects of introduced plague on Burrowing owls



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(*Athene cunicularia*) nesting in black-tailed prairie dog (*Cynomys ludovicianus*) burrows in northern Colorado. Prairie dogs experience high mortality from plague, and their colonies are periodically extirpated by outbreaks. Plague does not make owls sick, but they may be affected as unmaintained burrows collapse and become uninhabitable, vegetation grows taller, and the anti-predator benefits of prairie dog association are lost. From 2005–2008, we monitored 311 Burrowing owl pairs on the Pawnee National Grassland. We used generalized linear modeling to analyze the effects of rainfall, prairie dog town, and plague dynamics on nest fate, fledging success, and distances from each nest to its three nearest neighbors. Rainfall was the strongest predictor of nest and fledging success, with higher rainfall associated with lower breeding success. Nests were more likely to succeed when plague events were more recent, and they produced more fledglings on towns where any extirpation was brief, and prairie dogs were otherwise resident on site for a longer time. Nests were closest together on recently plagued towns where prairie dog activity had been nearly continuous for a long time and recolonization was rapid. Although ubiquitous on active prairie dog towns, Burrowing owls were nearly absent from towns that were not recolonized after plague epizootics. If conservation of Burrowing owls is a primary goal, our results suggest that it will be more useful to preserve prairie dog habitat and connectivity between towns at a landscape scale than to intensively manage plague.

Use of Carbon and Nitrogen Stable Isotope Signatures to Investigate Dietary Patterns in Wintering Golden Eagles (*Aquila chrysaetos*)

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Stable isotope analyses can enhance our understanding of ecological processes by providing insight into the behavior of contaminants in natural systems. We used stable isotope ($\delta^{15}\text{N}$ and $\delta^{13}\text{C}$) techniques to examine trophic relationships among 102 Golden Eagles wintering in the shrub-steppe habitats of Idaho and Montana and to improve our understanding of factors influencing the observed incidence of elevated blood lead levels (BLL) in these birds. We used data from eagles captured in east-central Idaho during winters 1989–1998; BLL were known for each bird. We examined the variance in isotopic signatures among individual eagles and specific demographic subgroups within the wintering population. Subadult eagles in our sample population had greater dietary diversity and were more likely to feed on prey with isotopic signatures outside the expected range of prey for Golden Eagles than adult birds. We also found greater within-population variability in C and N isotopic signatures, than variability in isotopic signatures of individual birds that we recaptured as much as 4 yrs apart. Estimates of the contribution of potential prey species to the diets of the wintering eagles using IsoSource mixing models were consistent with isotopes signatures of local deer (*Odocoileus hemionus*, *O. virginianus*), elk (*Cervus elaphus*), and jackrabbits (*Lepus californicus*, *L. townsendii*), and predators such as coyotes (*Canis latrans*) and fox (*Vulpes vulpes*). We conclude that these were likely principal prey species utilized by the wintering eagle population in the study area. Of nine factors modeled, the most important for predicting the incidence of elevated BLL in wintering Golden Eagles were the year birds were captured, and the $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ signatures consistent with potential prey like deer, elk and jackrabbits (results of TreeNet models with average accuracy: 70.7% and 83.1%, respectively for predicting elevated BLL vs. no elevated BLL in eagles).



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50-Year Golden Eagle Nesting Trends in South-Central Montana

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Golden Eagle (*Aquila chrysaetos*) migration counts in the western U.S.A. have shown a significant negative trend in recent years. However, the causes of these declines are unknown and it remains unclear if declining migration counts correlate to a declining population or changes in migratory behavior. Long-term research on nesting Golden Eagle populations is lacking and is needed to properly assess the current Golden Eagle population status in many areas. In 1962, intensive monitoring efforts were initiated in a roughly 1,200 mi² study area in south-central Montana. The objectives were, among other things, to determine density and productivity of Golden Eagles. This area was re-surveyed in the mid 1990s to begin looking at long-term population trends. We initiated a multi-year effort to investigate potential changes in the nesting trends in the same study area over a half a century. The data collected to date indicate an increase in the nesting density, similar nest success rates, and a decrease in productivity when compared with both the 1960s and 1990s studies. The longevity of data collected in this study area allows for one of the longest-term comparisons for Golden Eagle nesting density and success in the West and provides invaluable insights into the status of nesting Golden Eagles in this region.

Testing Survey Methods for Crested Caracaras (*Caracara cheriway*) in Florida

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Crested Caracaras (*Caracara cheriway*) are threatened in Florida and management relies on protecting nests identified during

surveys. If no nest is found, protective measures may not be applied, even in areas where breeding has occurred for many years. Thus, surveys that fail to find existing nests can lead to loss of nests or alteration of breeding sites, so it is important to understand the effectiveness of surveys. In 2007-2009 we surveyed 49 sites where breeding had occurred in the 1990s. We found nests at 81.6% (40 of 49) of sites we surveyed, and observed adult caracaras at each of the remaining sites. Thus, breeding sites appear to be occupied over periods of at least a decade. To assess factors affecting the probability of detecting existing caracara nests and adult caracaras occupying breeding sites, we used an information-theoretic approach to compare nested logistic regression models of detection of nests and adults. Surveys were composed of three visits. The probability that a nest would be detected during a visit increased by about 0.5% for each hour of experience up to about 70 hr (our maximum). The probability of detection of caracara nests and of sighting adult caracaras decreased by 2-3.5% for every hour after sunrise a visit was initiated. If visibility during any portion of a visit was obscured by fog or rain, the probability of detecting a nest decreased by as much as 60%, and the probability of observing an adult caracara decreased about 50%. Managers should use our estimates to calculate the probability of finding a nest during a visit, discard negative results from visits conducted under conditions which were unlikely to yield positive results, and insist those visits are repeated under better conditions. Otherwise management may inadvertently facilitate attrition of the Crested Caracara's breeding population.

Mercury, DDE, and PCB Trends in Bald Eagle Nestlings in the Upper Midwest

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We measured concentrations of DDE, total PCBs, and mercury in Bald Eagle (*Haliaeetus leucocephalus*) nestlings at three locations in the upper Midwest: Lake Superior, the upper Mississippi River, and the St. Croix River, 2006-2008. We also analyzed trends in concentrations of these contaminants for eagles on the southern shore of Lake Superior, from 1989-2008, using the current and previously published data. Concentrations of DDE in nestling blood plasma samples were greatest on Lake Superior (geometric mean: 16.2 µg/kg, $n = 29$), whereas concentrations of total PCBs were highest in Mississippi River samples (88.6 µg/kg, $n = 51$). Mercury concentrations were highest along the upper St. Croix River (6.81 µg/g wet weight in feathers, $n = 19$). For Lake Superior, DDE concentrations declined significantly in nestling blood plasma samples from 1989-2008, an average of 3.0% annually. Similarly, total PCBs in Lake Superior eaglets decreased 4.0% annually from 1989-2008, and mercury concentrations in nestling feathers from Lake Superior nests also decreased significantly from 1991-2008, 2.4% per year. With the possible exception of mercury on the upper St. Croix River, mean concentrations in 2006-2008 of all three compounds were below levels associated with significant impairment of reproduction for all sites, and reproductive rates at all three sites averaged >1.0 young per occupied territory, the threshold for a healthy Bald Eagle population.

The Pallid Color Morph of *Falco peregrinus cassini*: A History of Former Studies, a Summary of Recent Work, and Projections for Future Work

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Three decades ago there was a surge in efforts to study the Pallid Falcon (then also known as Tierra del Fuego Falcon, Kleinschmitt's Falcon, and *Falco kreyenborgi*). At that time, only a handful of specimens were known to science. In 1979, the bird was first photographed in the wild. In 1980, a recently fledged Pallid Falcon was found in a brood of Peregrine Falcons (*F. peregrinus cassini*) and a mixed pallid-normal pair (albeit without offspring) was found. Finally, in 1981 and 1982, several eyries were found in southern Argentina and Chile with various combinations of pallid and normal adults and young. From phenotype frequencies of offspring and parents came the conclusion that Pallid Falcons are homozygous recessive expressions of a single pair of genes. With that discovery, Pallid Falcon research ceased for nearly three decades. Only recently have Pallid Falcon studies (outlined in this paper) begun anew. From our 2009 survey in Patagonia, we present eyrie occupancy rates after a 29 year hiatus. We also illustrate the wide range in plumage variation in pallid and "normal" peregrines from Patagonia and discuss food preferences and reproductive rates. We also present preliminary results on exposure to selected avian pathogens and discuss conservation needs.

Can Detectability Analysis Improve the Utility of Point Counts for Temperate Forest Raptors?

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Temperate forest breeding raptors are poorly represented in typical point count surveys because these birds are cryptic and typically breed at low densities. In recent years, many new methods for estimating detectability during point counts have been developed, including distance, time-to-detection, multiple observer, and repeat visit methods. As a preliminary assessment of the performance of detectability models for forest raptors we used point count data on twelve raptor species over 15 years in four national forests in the Western Great Lakes. Total numbers of detections ranged from 7 (*Accipiter cooperi*) to 205 (*Buteo platypterus*), despite the large number of point counts completed per year (>1,000). Although these species differ considerably in life-history traits that should affect detectability during point counts (e.g., diurnal versus nocturnal habits), time-to-detection analysis nevertheless predicted consistently high per point detectability rates from 0.76 (*Buteo lineatus*) to 0.95 (*Bubo virginianus*). Our results strongly suggest that availability for detection, which is not measured by time-to-detection methods, is a critical component of detectability in temperate forest raptors. Of the four methods cited above (distance, time-to-detection, multiple observer and repeat visit) only the repeat visit method allows estimation of availability. We will illustrate, using formal analysis and simulation, that many visits would be required to achieve a reasonable detection rate.

Raptor Research: Where We Started, Where We Have Been, Where Should We Go?

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The modern raptor research era really started with the 1965 Madison Wisconsin symposium set up by J.J. Hickey in response to a population crash of the Peregrine Falcon (*Falco peregrinus*). The Raptor Research Foundation was founded following this meeting and became incorporated shortly thereafter. Its mission was “to stimulate the dissemination of

information concerning raptorial birds worldwide and promote a better public understanding and appreciation of the value of birds of prey”. Rachel Carson started the public discussion concerning organochlorine pesticides with her epic monograph, “Silent Spring” in 1962. Francis Hammerstrom’s work with the Northern Harrier (*Circus cyaneus*) was started in 1957, reported on at the 1965 conference, and eloquently publically published in 1986; she brought more focus on raptors and agricultural chemicals. Butch Olendorff studied raptors in the Pawnee Grasslands, and his book, “Golden Eagle Country”, took raptors from the scientific literature into the living room. Morlan Nelson’s passion for desert raptors resulted in protecting the Snake River Birds of Prey Natural Area. These early raptor biologists and “gabboons” made huge strides in protecting raptors and educating the public about raptor values. As a result, President Nixon banned dichloro-diphenyl-trichloroethane (DDT) and sodium fluoroacetate (Compound 1080) in the United States in 1972; Compound 1080 now has restricted use here. The Peregrine Falcon and Bald Eagle (*Haliaeetus leucocephalus*) have had celebrated recoveries. The raptor research community solved the mystery of a massive vulture die off from diclofenac. The California Condor (*Gymnogyps californianus*) is successfully being propagated, but lead poisoning is preventing true recovery. Despite these accomplishments, human overpopulation, habitat loss, poisoning of prey species, establishment of invasive species, and energy development are threats to raptors on all but a few landscapes. Where should we turn our focus for research, and why is public education and involvement so important to our success?

Aspects of the Ecology of Urban-nesting Bald Eagles (*Haliaeetus leucocephalus*) in South-coastal British Columbia

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In the past decade, Bald Eagle populations throughout North America have increased considerably and, despite their previous known avoidance of humans, eagles have begun invading cities in large numbers. The overall aim of this study was to document the ecology of urban Bald Eagle populations living in south-coastal British Columbia. We conducted a comparative study of the nest-site characteristics, productivity, and feeding habits of over 150 breeding pairs of rural, suburban and urban eagles. Tall mature trees are especially important for urban eagles and suburban areas have greater concentrations of nests. Nesting success and productivity for this population are some of the highest figures in North America. Human land-use and proximity to habitat edge are strongly linked to productivity and crows (*Corvus* spp.), gulls (*Larus* spp.) and pigeons (*Columba* spp.) are the most popular prey items for urban eagles. This study is expected to have implications for future management strategies of Bald Eagles in human-altered landscapes.

Recruitment of Local, Second Year American Kestrels into the Breeding Population: Who Comes Back and Why?

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Breeding populations typically consist of a mix of locally-produced and immigrant birds. Recruitment of locally-produced birds depends on survival and dispersal patterns. American Kestrels breeding in boxes in Southwestern Idaho were marked and monitored from 1992-2006. Over the 14 years of our study, the proportion of locally-produced American Kestrels that returned to breed in our study population varied. We hypothesized that factors that affect survival such as weather, physical condition, and parental care and factors that affect dispersal such as size rank (suggestive of social status) and parental lineage would affect recruitment rates. We used a mark-recapture model to understand factors that predicted return of nestlings. A small

proportion of the kestrels we banded as nestlings (4.8 % of males, 2.7% of females) returned to nest in the study area. Although few birds returned, their contribution to the local population was substantial. Offspring of locally-produced individuals were more likely to return than offspring of immigrants, birds hatched before less severe winters were more likely to return, and individuals that hatched earlier in the breeding season were more likely to survive and return the next year than later hatched birds. To further explore the significance of seasonal effects, we examined nestling and adult morphology from successful nesting attempts. Adult birds that produced young early in the season were larger (in better condition) compared to birds that produced young later in the season, and their nestlings gained weight at a faster pace. These results suggest that parent quality may affect offspring survival (and perhaps dispersal).

Investigating the Potential Risk of Secondary Rodenticide Poisoning to Barn Owls (*Tyto alba*) Inhabiting and Foraging in Urban Landscapes of the Lower Mainland, British Columbia

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Anticoagulant rodenticides are widely used to control pest rodents, but poisoning of non-target wildlife has been linked to these practices, including secondary poisoning of birds of prey, particularly owls. Although highly toxic second generation compounds, brodifacoum, bromadiolone and difenacoum, are restricted to the perimeter of buildings, they may still pose a serious hazard to owl species, which are already subject to multiple anthropogenic stressors. In this study, we investigated whether Barn owls inhabiting and foraging in predominantly urban landscapes of the Lower Mainland, British Columbia would be at higher risk of consuming rodenticide-laden prey, such as rats and house mice. By analyzing pellets, we found that Barn owls ate a variety of prey, with a total of 15 different species identified. Field voles (*Microtus townsendi*)



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were the main prey item, regardless of the amount of urbanization within their home range. However, consumption of rats and house mice appears to coincide with increased urbanization within home ranges. The shift in the diet of Barn owls living in urbanized areas may potentially lead to an increased risk of secondary rodenticide poisoning. In addition, we will discuss the preliminary results from our radio telemetry study investigating what habitat features urban Barn owls select as foraging habitat and whether they forage in proximity to buildings where rodenticide is being applied.

Insights into the Breeding Behavior and Dispersal of the Powerful Owl (*Ninox strenua*) Determined through the Collection of Shed Feathers.

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The Powerful Owl is a highly cryptic and elusive species inhabiting the forests of mainland eastern Australia. Despite extensive study, obtaining crucial information on aspects of their breeding behavior and dispersal has proven extremely difficult. This study applies a molecular approach to investigate the breeding behavior and dispersal of the Powerful Owl in two different habitat types; highly fragmented urban fringe (Melbourne) and continuous forest (East Gippsland). Powerful Owl DNA profiles were obtained predominately from shed feathers collected opportunistically between 1995 and 2006. Seven pairs of breeding powerful owls were identified, from which shed feathers were collected during 2003, 2004 and 2005. By comparing DNA profiles, one pair of owls was found to have occupied the same natal site for ten years (1995–2005). Dispersal / movements of five offspring from this pair were also determined. Two breeding pair of owls in the urban fringe habitat were closely related, and no incidences of extra-pair fertilization were detected amongst pairs in

either of the two habitat types. This study provides new information about the breeding behavior and dispersal of the powerful owl, and demonstrates the potential of using genetic data sourced from shed feathers for studying raptors.

The Clarion Burrowing Owl (*Athene cunicularia rostrata*), a Forgotten Subspecies

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Clarion Burrowing Owl is an endemic, endangered subspecies from Clarion Island, Revillagigedo Archipelago, Mexico. This volcanic island, 8.5 km long by 3.4 km wide with maximum elevation 320 m, is located 700 km southwest of Baja. We spent 18 days surveying the island from May 20 to April 7 and 15 days from 20 November to 3 December 2008. The owls were most abundant on the uplands between 140 and 220 m asl on moderate slopes. The owls used burrows constructed by introduced rabbits and natural lava cavities. The burrow entrances were randomly oriented. Their diet consisted of invertebrates almost exclusively. Beetles constitute the highest frequency (65%) followed by orthoptera (26%), Clarion Cricket, not yet assigned a scientific name, is one of the largest insects available. The rest of the items were spiders and caterpillars. One small mammal pellet contained part of a young rabbit. Previously undocumented, the owls were breeding in November 2008, likely in response to the summer rainy season. Stick-tight Fleas (*Echidnophaga gallinacean*) have been recently introduced on the island and intense infestations were observed on 8 owls. This remote island population appears secure for now but the impact of this new ectoparasite is unknown.



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Migration Routes and Wintering Areas of Short-eared Owls (*Asio flammeus*) Tagged in Nome, Alaska

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The Short-eared Owl has undergone a steep, long-term, and range-wide decline tantamount to a 70% reduction in population size in North America since 1966. The greatest conservation threat to the species is thought to occur on its wintering grounds, particularly for birds that breed in the northern extent of its range where habitat remains largely intact. Therefore, we harnessed 14 Short-eared Owls with solar-powered satellite transmitters in June 2009 in Nome, Alaska to address the following research objectives: 1) Identify wintering areas of Alaska's Short-eared Owls, 2) Identify migration routes, bottlenecks, and potential stop over areas, and 3) Describe migration strategies and wintering areas habitat associations. Owls established wintering areas across 25 degrees of longitude, from the Pacific Northwest east to the Great Plains, and 30 degrees of latitude, from the Prairie Provinces south to central Mexico. Straight-line migration distances ranged from 2,000–6,000 km. Short-eared Owls used two principal flyways: an inland route through the Prairie Provinces and Great Plains states and a coastal route through Southeast Alaska and British Columbia.

A Population Update of American Kestrels (*Falco sparverius*) in Eastern Pennsylvania (2006-2010): Trends in Nest Box Use and Productivity

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American Kestrels (*Falco sparverius*) have been reported by various researchers to be declining in many areas of North America and Canada. Various conservation strategies have been proposed to try to increase the overall reproductive success of this once common species. Our main focus is to present a population update to data previously presented from 1992-2005 on the use and productivity of American Kestrels nesting in boxes from the 2006-2010 breeding seasons. Population numbers on our nest box sites suggest that, although the number of pairs and the nest box use had declined during the 2000-2005 breeding seasons, there appears to be a slight increase in the number of kestrel pairs and nest box use, and a stabilization of the kestrel population from 2006-2010. An ancillary goal of our study during the nesting season of 2010 was to initiate a multiple year study to evaluate the effect of nest box inserts, designed to maintain clutch location consistency, on incubation efficiency and overall reproductive success in American Kestrels. The initial results from a subset of 37 box locations showed that kestrels that successfully used 4 of 18 boxes with inserts produced comparable hatchability and reproductive success when compared to kestrels in nest boxes without the inserts (7 of 19 boxes; hatchability 56% and 64%, respectively, and reproductive success 57% and 57%, respectively). We also propose additional conservation strategies over the next few breeding seasons, including increasing nest box numbers, and refining nest box placement to improve occupancy rates at nest box locations traditionally used unsuccessfully by kestrels, as attempts to increase nest box use and productivity.

Use Frequency of Individual Nest by Golden Eagles in Southwestern Idaho: Application to Management

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and KAREN STEENHOF, Owyhee Desert Studies, Murphy, ID U.S.A.

We assessed frequency of nest use by golden eagles in Southwestern Idaho from 1966 to 2009. Preliminary results show that eagles used between 1 and 19 nests in each of 66 territories and used individual nests between 1 and 26 times (mean = 3.5 times) over the years. Distance between adjacent alternative nests within each nesting area ranged between <1 to 1,800 m. Length of consecutive non-use ranged between 1 and 31 years (mean = 5.2 years). Eagles occasionally built new nests and, in most cases, laid eggs in the nest in the year it was constructed. However, a few nests remained empty for up to 6 years before being used. To assess long-term use frequency of individual nests, we examined use of 33 golden eagle nests between 1971 and 2009 in 33 different territories occupied in all years. Preliminary results demonstrate that eagles used these nests for an average of 6.6 years (range: 2-23 years). During the 39-year period, length of consecutive non-use for these 33 nests averaged 4.0 years (range 1-27 years). A golden eagle pair reoccupied a nesting territory that had been vacant for 16 nesting seasons and laid eggs in a nest that had not been used for 22 years. Effectiveness of current nest protection guidelines is discussed in relation to these results.

Investigations Of Pre-Nesting Survey Methods And Inventory Of The Short-Eared Owl (*Asio flammeus*) In Western Montana

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The Short-eared Owl is a grassland species that commonly breeds in Western Montana. The Short-eared Owl is likely of national conservation concern. However, conservation status is impeded by the fact

that this nomadic, nocturnal species is difficult to monitor. Information about the Short-eared Owls status derives primarily from the North American Breeding Bird Survey and Christmas Bird Counts. Although these programs provide valuable data about many species, they may be inadequate for evaluating the status of this owl. Thus, a standardized monitoring strategy is needed to compare data from all regions of the Short-eared Owl's range. To meet this need, we designed a roadside survey technique to determine presence of Short-eared Owls during courtship period. Surveys are conducted in the Mission Valley of western Montana, in spring 2009 and 2010. During these periods, we investigated visual and audio playback techniques for detecting Short-eared Owls. So far, we have found that visual, crepuscular surveys are most apt for measuring populations. 94% of detections were visual, rather than aural, and 62% of detections occurred during the period of 70 to 40 min before end of civil twilight. We have also determined that detections tend to be in areas consisting of uncut vegetation with a height of at least 30 cm (53%). These and other findings are presented, along with suggestions related to the development of a continental monitoring strategy for the Short-eared Owl.





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SPECIAL PRESENTATION: BRUCE C. MACDONALD, AECOM Environment, Fort Collins, CO U.S.A.

The presentation will review the overall basis for global warming through greenhouse gas accumulation in the atmosphere, and cite examples of global climate change, including regional depictions. The presentation will review USEPA's recent formal "endangerment finding" that requires regulation under the Clean Air Act, and will cite recent studies aimed at evaluating the impact of climate change on raptors and raptor migration. The important aspects of climate change related to future analyses of impact on birds will be reviewed.

Migratory Route of Two Golden Eagles between Southwestern Wisconsin and Northern Canada

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Yearly surveys indicate that there is a regular wintering population of Golden Eagles (*Aquila chrysaetos*) in Southwestern Wisconsin and Southeastern Minnesota. In 2009-2010 we used satellite GPS telemetry to track two eagles from this wintering range to their summer range around Hudson Bay, Canada. We tracked one bird on two spring migrations and in both years the route was northward around the western shore of Lake Superior through northeastern Minnesota and southern Ontario then north to the southwestern shore of Hudson Bay. The first summer was spent moving along the western shore of Hudson Bay then north and west to Franklin Lake near the Arctic Circle. Fall migration began on 7 October with the eagle traveling almost directly south through Canada, into north central Minnesota and then west into Wisconsin. This path covered 2,816 km in 26 d ranging from 0.77–273 km/d. In the second summer of tracking the eagle moved around the south shore of Hudson Bay then east into Quebec. The second eagle moved through northern Wisconsin on spring migration and

took an easterly route over Sault Ste. Marie through Quebec covering 2,710 km in 29 days. The summer was spent near the Labrador Sea. This information leads us to believe that Golden Eagles wintering in Wisconsin and Minnesota are likely from the listed breeding population in eastern Canada. Management of the wintering range will be important in the conservation of this population.

Nesting and Provisioning Behavior of Red-throated Caracaras (*Ibycter americanus*) in Central French Guiana

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The Red-throated Caracara is a widespread and common species in rainforests of the Neotropics. However, until now almost nothing was known of its nesting behavior. We used video recording technology to study nesting and nest provisioning behavior of Red-throated Caracaras at the Nouragues Station in Central French Guiana in the wet seasons of 2008 and 2009. In each of these two years, we recorded behavior at one nest site with one offspring each. The birds did not construct a nest, but used a large bromeliad epiphyte on emergent trees as a platform for raising the young. They provisioned the young primarily with nests of social wasps, followed - in order of decreasing proportion - by millipedes, fruits and small unidentifiable items. In 2009, at least six adult-plumage birds engaged in the provisioning of a single offspring, confirming reports that the Red-throated Caracara engages in cooperative brood care. Our findings have inspired many avenues for research on an enigmatic species.



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Precipitation, Phenology, and Raptor Productivity: a Nest-Level Analysis for White-tailed Hawks (*Buteo albicaudatus*) Breeding in South Texas

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The consequences of climate change, particularly variation in the amount of seasonal precipitation, can affect the productivity and timing of reproduction in birds of prey. We examined the relationship between precipitation, the onset date of egg laying, and the productivity of White-tailed Hawks in a 425 km² study area in South Texas (2003-2009). Monthly rainfall amounts were downloaded from the Oregon State Prism Data. The odds of a White-tailed Hawk nest to be successful increased by 36% (11-70%) with every 10 cm of rainfall during the breeding season ($n = 162$, $P = 0.0013$), and by 31% (4-69%) with the same amount during the previous non-breeding season ($P = 0.024$). The number of nestlings produced per nesting attempt increased by 33% (7-63%) with every 10 cm of rainfall during the pre-laying period ($n = 162$, $P = 0.009$). The number of fledglings produced per nesting attempt increased by 19% (2-36%) with every 10 cm of rainfall during the breeding season ($n = 162$, $P = 0.002$), and by 27% (11-45%) with the same amount during the previous non-breeding season ($P = 0.0004$). A tenth-fold increase in precipitation during the pre-laying period resulted in a 27% decrease (13-38%) in clutch initiation dates ($n = 62$, $P = 0.0006$). The odds of a nest to be successful decreased by 56% (27-77%) with every 20-day increase in clutch initiation dates ($n = 62$, $P = 0.001$). The number of fledglings produced per nesting attempt decreased by 33% (15-48%) with every 20-day increase in clutch initiation dates

($n = 62$, $P = 0.0003$). For every 20 cm of rainfall during the breeding period, the odds that a nest would get depredated during the incubation period decreased by 56% (23-76%, $n = 162$, $P = 0.005$), while the odds of depredation during the nestling period decreased by 43% (8-65%, $P = 0.024$). This study showed how various environmental and phenological factors can be used as predictors in terms of the reproductive performance of White-tailed Hawks in South Texas.

Spatial and Temporal Characteristics of Territories of Three Sympatric Raptors in South Texas

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Intra and inter-specific distances of nesting territories may shed light on the competitive interactions of sympatric raptors. We studied the spatial and temporal spacing of territories in White-tailed Hawks (*Buteo albicaudatus*), Red-tailed Hawks (*Buteo jamaicensis*), and Crested Caracaras (*Caracara cheriway*) in a 425 km² area in South Texas. The objectives of this study were to (1) investigate long-term patterns in territory configurations (2003-2009), (2) examine territory occupancy and quality, and (3) analyze the composition of land cover and patch characteristics within each territory. The size of White-tailed Hawk territories differed between 2004 and 2007 ($\chi^2_6 = 4.9$, $P = 0.03$), while being similar in all other years. The territory size of Red-tailed Hawks and Crested Caracaras was similar between years. Territories of White-tailed Hawks differed from Red-tailed Hawks ($\chi^2_6 = 11.91$, $P = 0.0005$), but were similar to Crested Caracara territories. The size of Red-tailed Hawk territories differed from Crested Caracara territories ($\chi^2_6 = 14.29$,



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$P = 0.0002$). Territory size in Crested Caracaras and Red-tailed Hawks was not related to the number of breeding pairs in a given year. The territory size of White-tailed Hawks decreased by 3% (1-4%) for every additional nesting pair ($t_{101} = -2.11$, $P = 0.04$). The interspecific distance of White-tailed Hawk nests to Red-tailed Hawk nests was twice as large as the intraspecific distance among conspecifics ($\chi_1^2 = 19.36$, $P < 0.0002$). On the other hand, the intraspecific distance among conspecific Red-tailed Hawks was similar to the distance to White-tailed Hawk and Crested Caracara nests. White-tailed Hawk nests were significantly further from the nearest road in comparison to Crested Caracaras ($\chi_1^2 = 8.63$, $P = 0.003$) and Red-tailed Hawks ($\chi_1^2 = 15.29$, $P < 0.0001$). The distances from nests to oil wells and windmills did not differ for any of the three species. The study showed that while territory size for the three species remained fairly uniform on the temporal scale, spatially the most significant differences occurred between the two Buteo species.

Habitat Properties of High and Low Quality Golden Eagle (*Aquila chrysaetos*) Territories

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Territory occupancy is used as a measure of territory quality to grade golden eagle territories based upon their reproductive success between the years 2000-2009 ($N = 86$) in boreal Sweden. The upper quartile ($N = 21$) was found to contribute a considerable proportion of both the annual productivity (44%) and the number of

successful breedings (43%) over the ten year period. These high quality territories are important for the population as a large inter-annual variation in both breeding success and productivity was seen. Having identified these more valuable territories, the study is used to advise wind power companies upon the siting of future wind farm development in northern Sweden. The remaining, lower quality territories contribute comparatively less towards the population with a gradual decrease in territory quality across the landscape. This variation in quality has further been explored with landscape based statistics, identifying habitat properties that characterise high and low quality territories in a geographical information system.

The reintroduction of the White-tailed Eagle (*Haliaeetus albicilla*) to Ireland

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A programme to reintroduce the white tailed eagle *Haliaeetus albicilla* to Ireland, where it became extinct in the early 20th century, commenced in 2007, and is managed in Ireland by the Golden Eagle Trust. In Norway, collection activities are organised by NINA and the Norwegian Ornithological Society. The first 15 chicks were collected in Trøndelag, Norway (always leaving at least one chick in nests) and released in Kerry, Ireland in 2007. The 55 birds exported 2007-2009 were flown directly to Kerry by charter aircraft, and released from holding cages in Kerry National Park in August-early September. Birds have been regularly monitored thereafter, made possible with wing-tags and VHF or GPS transmitters. Eight of 15 birds released in 2007, 14 out of 20 released in 2008, and 19 of 20 birds released in 2009 are known or assumed alive as of June 2010 (41 of 55 total). The expected cumulative survival rates, using a Kaplan-Meier survival analysis, were 0.85, 0.74, and 0.69 for year one, two, and three, respectively. Eight of the 14 deaths were due to poisonings. Assuming these birds



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would have survived otherwise, the cumulative survival rates would be 0.92, 0.87, and 0.87 from year one to year three, which would be exceptionally high for a wild population of this species. Poisons have been allowed in the Republic of Ireland to date due to derogations from the EU but are having a devastating impact on protected Annex 1 species. Strong new legislative measures are now proposed, including banning of poisoned meat bait altogether. The project is planned to continue until 2011, when a total of 95 birds will have been released to the wild during the course of the project. First breeding is expected in 2012 when the oldest surviving birds will be 5 years old.

Peregrine Falcons (*Falco peregrinus*) in Yellowstone National Park: from Theodore Roosevelt to the Present Day

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Peregrine Falcons have been observed enthusiastically in Yellowstone National Park (YNP) since its inception. Early visits by Theodore Roosevelt documented Peregrine Falcons near locations which are now known as contemporary nest sites. Peregrine Falcons in YNP remained at low numbers during the nadir of the population decline. In YNP, the current number of known nesting territories is 32 suspected sites, with recent park-wide confirmation of 26 locations. YNP is at a higher elevation relative to other areas in the northern Rockies, and because of that the nesting chronologies vary due to elevation and aspect of the cliff. Peregrine Falcons provide a focal species to the public and a method to interest them in raptor conservation. With 3 million annual visitors to YNP from throughout the planet all traveling within 1 mile of a Peregrine nest site at multiple times during their visit, Peregrine Falcons provide a charismatic toehold in the quest to provide the general public with knowledge of raptor ecology and conservation.

Determining Phenology of Raptors in Alberta, Canada from Volunteer Nest Cards

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In 1988, a volunteer raptor nest card program was initiated by Alberta Sustainable Resource Development (Alberta SRD) to enable raptor banders and researchers to collect information on nest locations of birds of prey. This program developed into the Alberta Raptor Nest Card Program and collaborated with the Prairie Nest Record Scheme. Nest Card data are stored with Beaverhill Bird Observatory and digitized data is submitted to Alberta SRD and the national Nestwatch Program run by Bird Studies Canada. We have analyzed the phenology of nine raptor species based on nest banding data. Egg laying results were: Great Horned Owl (*Bubo virginianus*) (January 28 to May 11), Swainson's Hawk (*Buteo swainsoni*) (May 6 to June 15), and Red tailed Hawk (*Buteo jamaicensis*) (April 6 to May 27); Barred Owl (*Strix varia*) (March 21 to April 30) and Northern Goshawk (*Accipiter gentilis*) (March 18 to April 22); Northern Saw-whet (*Aegolius acadicus*) (February 26 to June 18) and Boreal Owl (*Aegolius funereus*) (March 6 to April 6); American Kestrel (*Falco sparverius*) (April 19 to May 28); and Long-eared Owl (*Asio otus*). Data on phenology can be used by land managers to protect nests during the critical breeding season. We can also track occupancy rates and the productivity of nests over many years. Although American Kestrels appear to be declining based on Breeding Bird Surveys, our data from eight year of nestbox banding show that populations in central Alberta appear to be stable.

Health assessment of birds of prey (Aves, Falconiformes, Strigiformes) in Argentina: an overview of recent advances and future challenges

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Birds of prey (orders Falconiformes and Estrigiformes) are host for a wide range of macroparasites and microparasites. A large number are well known pathogens capable of causing disease, breeding failure and death in free-ranging birds. However, the population impact of infectious and parasitic diseases on birds of prey has received limited attention and remains poorly understood. Worldwide, most studies have emphasized availability of food, loss of habitat, persecution and environmental pollutants as main causes for demographic changes and population decline in these birds. For most of the 85 species of birds of prey inhabiting Argentina, their feeding and breeding ecology, population status and conservation threats have not been evaluated. Consequently, their health status and the role of macroparasites and microparasites on their populations also remain basically unknown. Limited advances in the knowledge of the health status of Argentinean birds of prey have been made in recent years, driven by the increased interest of wildlife biologists and veterinarians on the emergence and re-emergence of diseases associated with human population growth, environmental changes and encroachment of wildlife. In the following decades, conservation of Argentine birds of prey will be challenging. Sustained lack of habitat, human persecution and emergence of diseases will likely continue to negatively impact raptor populations. The inclusion of health assessments in raptor research will contribute to a better understanding and prevention of stochastic demographic changes in Argentine birds of prey. A conservation medicine approach and the collaborative work of scientists coming from various disciplines, specially medical and biological sciences, are needed to effectively address these challenges.

The Influence of Prey Abundance and Weather on Northern Goshawk Reproduction in Arizona

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The need for a process-based approach to forest management has increased since historical conditions may no longer be applicable given the effects of climate change on forest composition, structure, and function. The relationship between Northern Goshawk (*Accipiter gentilis*) reproduction, populations of prey species, and the natural structure and species composition of forest ecosystems may provide an appropriate template for forest management under heterogeneous and changing environmental conditions. To understand the potential impacts of climate change and associated habitat alteration on goshawk reproduction, we need to identify the environmental variables that have the greatest influence on nestling survival. Thus, we evaluated fledgling production from 210 goshawk nesting attempts on the Kaibab Plateau, Arizona during 1999-2004 in relation to prey density, temperature, and precipitation variables. Initial analyses indicate that the mean number of fledglings produced varied annually ($F_{5, 204} = 7.45$, $P < 0.001$) and ranged from 0.74 ± 0.19 to 2.12 ± 0.15 . Due to high model selection uncertainty, there was little evidence to infer a single best model because the top five models had substantial support in the data and contained over 90% of the weight of evidence. However, red squirrel (*Tamiasciurus hudsonicus*) density was included in four of the top five models and May weather variables were included in all models with some weight of evidence ($n = 8$). Our results suggest the abundance of an important prey species and spring weather conditions interact to limit nestling survival.



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by potentially reducing female brooding activities at a time when young goshawks are poor at thermoregulation and more vulnerable to weather extremes.

Using Woodpeckers to Predict the Occurrence of Cavity Nesting Owls

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Flammulated Owls (*Otus flammeolus*) and Northern Saw-whet Owls (*Aegolius acadicus*) are small, secondary cavity nesters that require formation of natural cavities or, more commonly, cavities created by woodpeckers for nesting opportunities. We investigated whether the inclusion of potential biotic interactions predicted occurrence of cavity nesting owls in the Boise National Forest, located in southwestern Idaho, U.S.A. Specifically, we hypothesized that including woodpeckers, which excavate nest cavities that ultimately become available for a variety of owl species, in occupancy models would improve predictions of cavity nesting owl occurrence. To evaluate this hypothesis we located owls by broadcasting conspecific vocalizations during nighttime hours at point-count locations ($N = 153$) during the 2009 and 2010 breeding seasons. We surveyed for woodpeckers at these same locations during daylight hours in a similar manner playing broadcasts for Northern Flickers (*Colaptes auratus*), Lewis's Woodpeckers (*Melanerpes lewis*), Hairy Woodpeckers (*Picoides villosus*), Pileated Woodpeckers (*Dryocopus pileatus*), and Red-naped Sapsuckers (*Sphyrapicus nuchalis*). We simultaneously modeled habitat covariates and biotic interactions using two-species occupancy models to determine whether owls and woodpeckers occurred independently, or if there was evidence of

facilitation between woodpeckers and owls. Initial results from 2009 indicate that Flammulated Owls were more likely to occur at sites also occupied by Hairy Woodpeckers, while no woodpecker species were related to Northern Saw-whet Owl occurrence. Using cluster analysis on nest-cavity dimensions obtained from the literature, cavity size and shape of cavities used by Flammulated Owls clustered most closely with those of Hairy Woodpeckers. Thus, it is possible that this biotic interaction contributes to the co-occurrence that we observed. Our analyses will be augmented with owl and woodpecker data collected in the 2010 breeding season.

What is a Bird? An Evolutionary Approach

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What makes a bird a bird? I review the recent record of fossil discoveries of birds and their theropod relatives. In the fossil record, the line between Aves and Theropoda is blurred, as might be expected from any well-known evolutionary transition. Modern biologists have little difficulty recognizing members of the class Aves in the field because of the many distinctive characteristics of this clade. Modern birds are feathered, egg-laying, bipedal endotherms that typically possess beaks, lack teeth, have light but strong skeletons with a reduced number of digits on the forelimbs, a four-chambered heart, and a distinctive and highly efficient respiratory system. This striking constellation of characters provides birds with an excellent adaptation to flight and is discernible even in the bodies of flightless birds. The tightly-woven package of avian features can be unraveled by considering the fossil record. Feathers are thought of as the quintessential bird characteristic, but new fossil discoveries have yielded several surprises in their evolution. Feathers were probably one of several piecemeal adaptations that had different original functions but which were later co-opted for flight. First of all, many theropod dinosaurs that are not possibly



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birds or volant possessed feathers. Second, in some cases, these feathers are present only in juveniles. Third, proto-feathers, rudimentary feathers, and full feathers are preserved in a range of extinct species that do not represent an evolutionary lineage, suggesting the evolution of feathers was widespread among theropods. Importantly, some of these early feathers show banding that suggests elaborate color patterns and sexual display, an apparently ancient behavioral trait that is well-developed in modern birds.

Inherited Characteristics of the Vocalizations of American Kestrel (*Falco sparverius*) Chicks: Variation Within and Among Broods

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We studied the vocalizations of American Kestrel chicks to determine if the acoustical characteristics of the calls of siblings were more similar to each other than to those of unrelated chicks. Our study population breeds in nest boxes we erected in rural habitats of northwestern New Jersey. We audio-recorded nestlings when they reached 16-22 days old, by which time they produce an adult-like "klee" call when handled. We obtained a total of 144 audio samples from 67 female and 77 male kestrel chicks during 2005 and 2006. We digitized the analog recordings and measured 15 acoustical parameters of each "klee" note, including duration of note, interval between notes, number of distinct harmonic overtones, the harmonic frequency of greatest amplitude, and 11 other measures of audio frequency. Female chicks produced notes with significantly more harmonic overtones than those of male chicks; no significant differences between males and females were found in the other 14 acoustical parameters. Interbrood variability was significantly greater than intrabrood variability for all but 3 of the 15 parameters (interval between notes, number of harmonics, and frequency below which 75%

of the acoustical energy is present), indicating that broodmates sound more similar to each other than to unrelated chicks. We discuss the possible mechanisms by which these characteristics are inherited.

The Yellowstone Raptor Initiative: An Open Call for Cooperators in the Shadow of Theodore Roosevelt

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The ecological contribution of predators such as grizzly bears (*Ursus horribilis*), wolves (*Canis lupus*), and coyotes (*Canis latrans*) has been well documented in Yellowstone National Park (YNP). While these terrestrial predators serve as keystone species in the park, the landscape scale effects attributed to them do not encompass the aerial niche held by raptors. Awareness of raptors as an ecosystem driver has long been overlooked, and is only now perceived in other habitats as a primary or secondary contributor to top down trophic cascades and ecological functioning of Rocky Mountain systems. During a visit to YNP with his family in 1890, Theodore Roosevelt recorded Peregrine Falcons (*Falco peregrinus*), and his personal favorite, Golden Eagles (*Aquila chrysaetos*) in areas where these raptors have recently been rediscovered. Picturesque sightings of raptors augment a visitor's experience; whether it is a Bald Eagle (*Haliaeetus leucocephalus*) or Osprey (*Pandion haliaetus*) on Yellowstone Lake, a quick glimpse of a Peregrine Falcon flying near Yellowstone Falls, or a Great Gray Owl (*Strix nebulosa*) perched on a snag within easy viewing distance on many of the available Park Service roadways or trails. Yet despite visibility and generally positive perception, knowledge of raptors, ecological impact and connectivity of raptors to prey populations, and annual or decadal cycles of prey are currently unknown within YNP.



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Further, raptors serve as an upper trophic level species and are often used as toxicological and ecological indicators providing input to decision makers on organochlorine contaminants, climate change, ecosystem shifts, trophic cascades, and prey presence and availability. In the spirit of T.R., we have developed the Yellowstone Raptor Initiative, where we invite and warmly encourage rigorous approaches to advance our understanding of raptor ecology within YNP.

A World Class Raptor Area in Arizona: a Comparison of Raptor Breeding Density and Diversity between Cave Creek Canyon on the Coronado National Forest and the Bureau of Land Management's Morley Nelson Snake River Birds of Prey National Conservation Area in Idaho

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I studied the density and species diversity of nesting raptors in Cave Creek Canyon in southeast Arizona's Chiricahua mountains on the Coronado National Forest. 24 species of raptors nested on a 50 km² study area in Cave Creek Canyon, versus 16 species at the Morley Nelson Snake River Birds of Prey National Conservation Area (SRNCA). An additional six species nested within 20 km of the Cave Creek Canyon study area, and six more occur in winter or as regular migrants, for a total of 36 species. Using similar criteria for inclusion and similar methods to those used to census raptors in the SRNCA in Idaho, I found 305 pairs of nesting raptors in the 50 km² study area in Cave Creek Canyon, or over five times the density reported for the SRNCA. Small owls comprised 80% of the nesting raptors. Cave Creek Canyon has 12 species of owls, 11 nesting and one wintering. Whiskered Screech Owl (*Megascops kennicottii*) was the commonest raptor, with 73 pairs. Elf Owl (*Micrathene whitneyi*), Western Screech (*Megascops trichopsis*) and Pygmy Owls (*Glaucidium gnoma*) were the next most abundant with 64, 45, and 25 pairs respectively. The American Museum of Natural History's Southwestern Research Station draws biological researchers from all

over the globe, and Cave Creek Canyon is a world-class birding destination. Of the local businesses, 94% depend on the area's famous biodiversity or the resulting ecotourism. Because of the numbers of Mexican Spotted Owls (*Strix occidentalis lucida*), the Chiricahuas have been declared a Globally Important Bird Area by the American Bird Conservancy. Future management should take into account the area's extraordinary raptor diversity and concentration, with special emphasis on the remarkable density of owls. The US Forest Service is being requested to create a Special Designation for Cave Creek Canyon, managed for research and birding.

Effects of Habitat Fragmentation on the Breeding Ecology and Territory Size of Harris's Hawks in the Desert of Baja California Sur, México

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We are studying the effects of habitat fragmentation on the breeding ecology and territory size of Harris's Hawks (*Parabuteo unicinctus*) in the desert of Baja California Sur, México. Information on the nesting ecology of Harris's Hawks has been obtained from a population of a central valley in the middle of south Baja California peninsula. During 2009 we monitored 12 nests in the fragmented area and 8 nests in natural areas. Active nests were found from February to November, but most nesting activity occurred from March to June. Clutch size did not differ between fragmented (2.90 ± 0.83) and natural areas (2.85 ± 0.69). Percentage nesting success was different, being 83.3% for fragmented and 62.5% for natural areas. Productivity (fledglings/successful nest) was 2.0 ± 1.15 in fragmented area and 1.6 ± 0.54 in natural area. The size of patches influences the number and presence of nests. No active nests were found in small patches (< 25 ha) while nests were found in medium (30-185 ha) and large patches (>220 ha).



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Telemetry shows that the territory size varied more widely in the fragmented area (130-393 ha, $N = 5$ birds) than in natural areas (195-242 ha, $N = 4$ birds) (using the Minimum Convex Polygon). Apparently a higher nesting success and productivity exist in the fragmented area; however a continuous decrease of patch size will affect the presence of active nest and then the demography of Harris's Hawk population in fragmented areas. Additionally, we found that patches are important hunting areas within their territory in fragmented areas.

The Influence of Food Amount, Hatch Order, and Sexual Size Dimorphism on Sibling Aggression in Red-Shouldered Hawks

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Sibling aggression in raptors, although often reported, has not been well studied in terms of its ecological and evolutionary significance. In siblicidal birds, the amount of food delivered to the young, hatching sequence, and gender have been proposed as key factors influencing sibling aggression. We experimentally manipulated and monitored 20 Red-shouldered Hawk (*Buteo lineatus*) nests in 2004 and 2005 using surveillance cameras. Of these nests, 10 were supplemented with food and 10 were control nests. Aggressive behaviour was significantly higher in un-supplemented (mean \pm SE = 2.26 ± 1.03 acts/chick/hr) nests than supplemented nests (0.74 ± 0.22 acts/chick/hr; $P = 0.04$). First-hatched nestlings in un-supplemented nests were more aggressive (1.76 ± 1.04 acts/chick/hr) than first-hatched (0.29 ± 0.07 acts/chick/hr), second-hatched (0.41 ± 0.20 acts/chick/hr), or last-hatched nestlings (0.12 ± 0.04 acts/chick/hr) in supplemented nests. Within un-supplemented nests, first-hatched nestlings consumed significantly more food (2.88 ± 0.56 g/chick/hr) than second-hatched nestlings (2.24 ± 0.49 g/chick/hr). Gender had no effect on aggression level or

the amount of food consumed by nestlings ($P > 0.5$). The interaction between hatch order and food supply was highly significant ($P = 0.01$) and may influence sibling aggression in Red-shouldered Hawks more than the single factors examined. These findings suggest that under food stress, asynchronous hatching in raptors acts to intensify rank within the brood. During times of intense food shortage, first-hatched nestlings become aggressive and monopolize the majority of food brought to the nest by adults causing the mortality of last-hatched chicks. This is likely a beneficial adaptation for hawk parents and their surviving young by adjusting the brood size and producing only the number of healthy fledglings that may be best supported by the available food resources.

Spatial Ecology of Northern Spotted Owls and Barred Owls in Western Oregon

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Competition with Barred Owls (*Strix varia*) is an increasingly relevant factor to consider in managing threatened Northern Spotted Owl (*Strix occidentalis caurina*) populations and their habitats. Potential mechanisms of competition between the two species include aggressive displacement from breeding areas or exploitation of shared prey resources. We investigated diets, home range size, and patterns of spatial overlap among radio-marked Spotted Owls and Barred Owls in western Oregon during 2007-2009. Mean annual 95% fixed-kernel home range size of Spotted Owls (2837 ± 310 ha, $n = 38$) was 3–4 times larger than that of Barred Owls (798 ± 56 ha, $n = 41$). Percent home-range overlap among space-sharing heterospecific individuals was highly variable, ranging from 1 to 80%. Based on probabilistic measures of spatial



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overlap that account for a gradient in use intensity within the home range, Barred Owls were more than twice as likely to be located in areas of overlap than Spotted Owls were. Moreover, Barred Owl incursions into areas of concentrated use by neighboring Spotted Owls were common, but Spotted Owls rarely, if ever, ventured into Barred Owl core use areas despite extensive overlap among broader foraging areas. Our results are consistent with the hypothesis that territorial Barred Owls use smaller home ranges than Spotted Owls because they are generalist predators that forage opportunistically across a range of different forest types whereas Spotted Owls prey selectively on nocturnal mammals associated with older forests. Despite the emerging evidence of spatial exclusion, seasonal differences in habitat selection and foraging behavior between the species may allow land managers to recognize specific physiographic conditions where Spotted Owls are most likely to be susceptible to competitive pressure from Barred Owls.



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The Windfarm Development in Spain: Impact and Correction Measures on Raptor Species

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Spain is one of the leading countries in the world on windfarm development, accounting for 19,149 MW by the end of 2009. However, turbines cause impacts on birds and bats, being collision with blades the most noticeable. The study covered a large region in Northern Spain (300 km long and 100 km width) with 171 windfarms (4061 turbines), where 50% were sampled. At least 11 raptor species were registered (vultures, eagles, kites, kestrels and harriers), being the Eurasian Griffon Vulture (*Gyps fulvus*) the most affected (53-75%). None of the collided birds was released again with only 2% surviving. Causes of collision were analyzed considering breeding and feeding requirements of the species, climate conditions and site location of turbines. Seasonal mortality pattern (on average 70% in winter and autumn) was related with the two former aspects. Results revealed that temperature played an important role on flying behavior and collision risk. Site location also affected with 10% of turbines causing 60% of mortality. Despite most dangerous turbines were identified, neither relocation measures nor plan for reducing mortalities have been considered. Furthermore, despite windfarms are located outside protected areas, they affected species breed at protected ones. Nowadays, authorities only account for bird losses with no management. Castellón is the only region where windfarm developers have been taken to the court. Environmental changes - food lacking for vultures as a consequence of the Bovine Spongiform Encephalopathy - greatly increased its mortality. Management of feeding sites, two new vulture restaurants were opened, reduced collision risks by diminishing crossings through dangerous areas. This revealed how adaptive management is a useful management tool to make windfarms and birds compatible. Its

use according with existing Spanish legislation and guidelines from authorities is discussed.

Ex Post Compensation for White-Tailed Eagle (*Haliaeetus albicilla*) Impacts at the Smøla Wind Farm: an Application of Equivalency Analysis

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Current environmental compensation schemes for wind power fail to demonstrate connections between ecological damage and compensating ecological gains made through restoration. Equivalency Analysis (EA) is a quantitative approach for scaling compensation that is frequently applied in cases of bird losses from oil spills. The EA described herein uses a non-monetary "bird-year" metric to quantify the loss to the public associated with White-Tailed Eagle (WTE) turbine collisions at the Smøla Wind Farm (debit) and then, using the same metric, scales electrocution mitigation measures at nearby power lines as compensation (credit). Thirty-six WTE deaths from turbine collisions (2005-2010) resulted in a debit of approximately 1,320 discounted bird-years, which captures lost life expectancy from direct mortality and indirect reproduction losses. Preliminary data from 2010 indicate that WTE electrocution mortality on Smøla ranges from 0.01 to 0.15 deaths per year per pylon, depending on pylon type. We assumed that a project that retrofits pylons to prevent WTE electrocution leads to a 100% reduction in electrocution mortality, and calculated compensation credit per retrofitted pylon based on the life expectancy of a typical WTE that avoids electrocution. Given this information, we scaled compensation (pylons retrofitted) under alternative scenarios, all of which ensure "equivalence" between loss and gain measured by our resource-based metric. Results indicated that scaled compensation varied depending on the type of pylon and species addressed. This *ex post* study quantifies documented impacts through



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August 2010 and can be adjusted to reflect projected losses or revised in light of new information (e.g., displacement or reduced reproductive success). The study raises several issues for discussion: when compensation for wind power is appropriate, how much is enough, who is responsible, which species should benefit, what restoration projects are relevant, and what metrics best capture environmental loss and gain.

Electrocution Assessment of Power Lines Serving a Wyoming Oil and Gas Field

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Golden eagle (*Aquila chrysaetos*) electrocutions are a persistent problem in the western United States with Wyoming having a high electrocution rate. The USFWS reports 1,240 reported eagle electrocutions in Wyoming from 1990 to 2010. These records are primarily for Golden eagles and include less than 20 Bald eagles (*Haliaeetus leucocephalus*). Approximately 500 of these eagle incidents occurred in the Big Horn Basin [Park Co, Big Horn Co, Hot Springs Co. and Washakie Co.]. These numbers are conservative since electrocution reporting was not a priority for some companies prior to 2004, and some electrocutions go undetected. Over 12 days we inspected 1,841 distribution power poles serving Wyoming oil and gas wells, detecting 27 raptor carcasses including 15 Golden eagles. Fifteen percent of the structures ($n = 277$) were single-phase lines with most (79%, $n = 220$) constructed as raptor-friendly. The remaining single-phase poles (21%, $n = 57$) were equipment poles either partially retrofitted (e.g., transformer poles with covered jumpers but missing bushing covers), or without any protective insulation. Two raptor carcasses and a bobcat (*Lynx rufus*) were found under unprotected single-phase poles. One hawk carcass was found under a partially retrofitted single-phase structure. The remaining 1,564 three-phase structures included 126 poles (8%) constructed as

raptor-friendly. The remaining poles were either partially retrofitted (12%, $n = 193$) or without any mitigating measures (80%, $n = 1,245$). No carcasses were found under fully retrofitted poles and two golden eagle carcasses were detected under one partially retrofitted pole utilizing perch discouragers. The remaining 21 carcasses were detected under completely unprotected poles. Eleven carcasses were associated with unprotected equipment poles, seven with intersection/corner poles, and six with tangent structures. The strongest mortality correlation was with gapped type lightning arresters. Three raptor carcasses and a bobcat were found under the six structures with these older type arresters.

Raptor Nest Management Programs at Two Canadian Electrical Utilities

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The impacts of power line development and operation on raptors vary; while most are considered negative (e.g., direct mortality from electrocution and collision, indirect impacts through habitat loss, disturbance of nearby nests during construction and operation), power lines undoubtedly benefit raptors in many ways. Power poles function as hunting perches, feeding posts, territorial boundary markers, roosting sites, and perhaps most importantly, nesting substrates. Offering unobstructed views from which to hunt and survey for predators, protection from mammalian predators and ground fires, and even shelter from the elements, power poles are likely irresistible to breeding raptors, particularly in more open country habitats where natural nest sites are limited. Not surprisingly, raptor nests on power poles can cause serious operational issues for utilities when nest material contacts energized hardware, streamers cause flashovers, or excrement builds up on the equipment. Further, these precariously placed nests often pose a significant risk of electrocution to the birds themselves. Appropriate and timely management of these nests poses



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significant challenges; actions must comply with provincial and federal wildlife legislation, must minimize disturbance to and ensure the safety of the birds, and ideally, should not compromise the electric system. We will present elements of raptor nest management programs from the first two electrical utilities in Canada (both from the province of Alberta) to have developed formal Avian Protection Programs. These programs include strategies to minimize disturbance to nesting raptors during construction, management of Osprey (*Pandion haliaetus*) nests on existing electrical infrastructure, and habitat enhancement initiatives focused on the Ferruginous Hawk (*Buteo regalis*), a species at risk at both provincial and federal levels. Challenges and successes of these fledgling programs to date will be discussed.

Bird Electrocutions on High Tension Distribution Power Lines in Andhra Pradesh, India - Species Recorded, Modes of Electrocution and Pole Configurations

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Bird electrocution on power lines is a global hazard. This issue is well recognized across the world, but has received no attention in India. There's paucity of data on bird electrocutions in India. Between May 2006-November 2007 sections of three high-tension (HT) three-phase distribution power lines (one 33 kV and two 11 kV) passing through habitats used by raptors were selected within a 50 Km radius of Hyderabad City for exploratory surveys to document raptor electrocutions, establish modes of electrocution and document pole configurations responsible for fatalities. Incidental bird electrocutions documented on other trips between May 2006-March 2010 were also included. 35 33 kV and 40 11 kV poles were inspected; 17 bird electrocutions of seven species, including three raptor species were documented. 23.5% ($n = 8$) of the 34 inspected 11 kV tangent poles and 25% ($n = 1$) of the four

inspected 11 kV double dead-end poles accounted for 88.2% fatalities. 19 incidental electrocutions of 11 species, including three raptor species were documented on three-phase HT lines; tangent poles, corner poles and double dead-end poles accounted for 14, three and two fatalities respectively. In Andhra Pradesh and across India, distribution lines utilize steel/concrete poles with metal cross arms (upright pin-type insulators) and the pole and cross arm are used as grounded earth. 91.6 % ($n = 33$) of the fatalities ($n = 36$) were attributed to 11 kV lines. Owing to larger extent and further reduced clearances, 11 kV lines appear to be more lethal than 33 kV lines in Andhra Pradesh. Of the 36 electrocutions, 27 were due to ground faults, illustrating that the critical clearances for birds on steel/concrete poles are, phase-to-ground. Birds as small as White-Browed Wagtail (*Motacilla maderaspatensis*) and Red-vented Bulbul (*Pycnonotus cafer*) were documented bridging the phase-to-ground separation, showing that birds of all sizes are at equal risk of getting electrocuted. In the absence of bird-safe standards for power line construction, widely varying and hazardous configurations exist in power line networks, and unless they are made safe, power lines across India will continue to electrocute birds of all sizes.

Estimating Raptor Electrocution Rates and Interpreting Mortality Data

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Study design and sampling issues have limited the usefulness of research on raptor-power line electrocutions throughout the world. Here, we summarize the basic principles of study design and sampling as they relate to raptor electrocution research in general and mortality rate estimation and interpretation in particular. To provide a real world model for assessing risk and designing protection strategies, we also summarize results of a recent study we conducted in the western U.S. that included rate estimates of mortality before and after



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retrofitting, and evaluation of biasing factors. We conducted randomized mortality searches, necropsies, carcass removal trials, and estimated raptor densities to provide evidence of a 47% reduction in mortality due to raptor protection efforts. Rate estimates (0.0036–0.0112 deaths/pole/yr) may have been biased by the effects of scavengers and by long sampling intervals (≥ 3 months) which prevented us from determining cause of death for most birds. When we reduced sampling intervals to 1 month and we nearly tripled the number of birds suitable for necropsy, but were still unable to establish cause of death for $\geq 40\%$ of our sample. Instead of eliminating unknowns from rate estimates, we estimated minimum electrocution rates using confirmed electrocutions only and maximum rates based on all available mortalities, including those without known causes. Raptor densities did not change during our study, suggesting the reduced electrocutions were not the result of changes in raptor populations. However, estimates of raptor densities before retrofitting were not available and we cannot be sure that numbers of birds using the study area before and after retrofitting were similar. Our research emphasizes the difficulties of estimating electrocution rates precisely, but suggests that utilities will have the greatest effect on mortality by monitoring power lines at large scales and focusing mitigation in areas that pose the greatest risk.

Influence of Landscape Configuration on Wind Farm Frequentation by Golden Eagles (*Aquila chrysaetos*) – a Case Study

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Wind energy is expanding all around the world and Quebec plans to increase its production from about 500 MW today to 4000 MW in 2015. Golden Eagles are among the wildlife species known to be vulnerable to blade-strike mortality. Not all wind farms present the same collision risk; windmill configuration and site particularities are two major parameters that influence such risks. The present study aims to determine how habitat configuration affects space use of breeding Golden Eagles, with a particular focus on areas adjacent to wind farms. We hypothesized that a greater availability of open habitats in the vicinity of wind farms will increase the use by Golden Eagle of the wind farm area. Our study area is located in the Gaspé Peninsula (Quebec), and Golden Eagles were tracked with Argos/GPS solar transmitters. Preliminary results show that eagles whose nests are established in areas with high availability of open habitats had smaller home ranges and were less susceptible of using open habitats surrounding wind farms. Where availability of open habitats was lower close to Golden Eagle nests, openings created near wind farms offered new hunting areas, increasing frequentation of wind farms by Golden eagles, thus increasing potential risk of blade-strike mortality. Hence, developers aiming to establish wind farm projects in forested mountainous areas, as is the case for many projects in Eastern North America, should consider that creating openings within a forested habitat may increase collision risk for Golden Eagles.

Steps to Avoid or Minimize Take and Disturbance of Raptors at Power Lines and Commercial Wind Turbines

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Collisions with and habitat fragmentation resulting from the siting of power lines and commercial wind energy facilities are causing increasing concerns. These specifically relate to the documented impacts to raptors, especially Golden Eagles (*Aquila chrysaetos*), Bald Eagles (*Haliaeetus*



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leucocephalus), and other North American birds of prey. This presentation focuses on efforts being taken to address collisions and fragmentation issues at power distribution and transmission lines and land-based commercial wind facilities. Specifically, the presentation will review new power line collision and fragmentation reduction findings pertinent to raptors that update the 1994 document, *Mitigating Bird Collisions with Power Lines*, currently being rewritten by members of the Avian Power Line Interaction Committee. Also discussed are several company-specific efforts to address raptor collision issues at power lines through development and implementation of avian protection plans. To address raptor collision and fragmentation issues at wind energy facilities, this presentation also briefly reviews the current status of recommendations – including some that are raptor-specific – presented to the Secretary of Interior from the Wind Turbine Guidelines Federal Advisory Committee in March 2010 which ultimately will serve as the foundation for updated guidelines developed by the U.S. Fish and Wildlife Service. Lastly, the development of a template for [USFWS] *Interim Guidelines for the Development of a Project Specific Avian and Bat Protection Plan for Wind Energy Facilities* will be reviewed as it pertains to raptor issues other than eagles in North America.

Methane Burners: Better Management Practices in the Making

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Methane burners used in landfill operations can have significant adverse effects on raptors. Pipes or stacks transport landfill gases, composed primarily of methane produced by decomposing organic materials, from the pit to the burner to be ignited and burned-off. These stacks provide ideal perch sites for raptors attracted to landfills by hunting opportunities. However, the unprotected flame emitted from the burner is virtually invisible, resulting in direct mortality or injury to birds that perch or fly over the flair. The magnitude of the problem may be under reported as carcasses may be

scavenged quickly, birds may disappear in thick grass/weed vegetation and employees may not frequent the premises of closed landfills to witness the problem. Additionally, observations of singed feathers may easily be mistaken for electrical burning or even feather lice. After visiting existing burners in the state of Massachusetts, it became apparent that operators were either unaware of the problem or if they did know about it, they knew no means to reduce the hazard to birds. Protective devices are needed to reduce the risk of effects on raptors. This problem requires solutions by the manufacturers, and cooperation of the landfill operators and public. In this study, a crown was designed and retrofitted on a stack where documented raptor injuries occurred in 2009. Impacts may be reduced by addressing aspects of landfill design that lure birds dangerously close to the burner flame. These include the removal of perching opportunities near the vicinity of the burner. Several wildlife rehabilitation facilities, falconry and birding organizations are addressing this problem through public and manufacture awareness. We will discuss options available to reduce these problems.

Long-term Trends for Nesting Raptors and Prey Populations Relative to the Effects of Surface Coal Mining on Nesting Raptors in Northeast Wyoming

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Long-term annual monitoring data in northeast Wyoming have demonstrated that a variety of raptor species consistently nest near, and in view of, disturbance associated with active surface coal mines. Some pairs of Great Horned Owls (*Bubo virginianus*) and Red-tailed Hawks (*Buteo jamaicensis*) regularly nest on the active mine features (e.g., coal or overburden highwalls) and facilities (e.g., operating coal crushers) themselves. Other pairs and species regularly nest within approximately 60 m to 1.6 km, and in view of mine-related disturbance; the required annual monitoring perimeter extends 1.6 km beyond the mine



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permit areas, though some mines voluntarily monitor out to 3.2 km each year. These repeated nesting efforts demonstrate that some raptors can acclimate to high levels of activity near their nest sites. In fact, active and/or successful raptor nests are often closer to mine-related disturbance than are inactive and/or unsuccessful nests. This acclimation is likely related to the relatively slow, methodical encroachment of mine operations into and through active raptor territories. Results from long-term annual monitoring of prey populations have provided additional evidence that raptor nesting efforts and productivity at these surface coal mines have been influenced primarily by natural factors such as prey abundance, though untimely inclement weather events and the availability of nesting substrate also play a role. Lagomorph (hares [*Lepus* spp.] and rabbits [*Sylvilagus* spp.]) indices and production by the larger raptor species (Golden Eagles [*Aquila chrysaetos*], Ferruginous Hawks [*Buteo regalis*], Red-tailed hawks, and Great Horned Owls) at multiple coal mines in northeast Wyoming have shown strong correlations over their long-term trends. Understanding disturbance tolerances and limiting factors in raptor productivity are vital in implementing successful nest relocations at surface mines, which help to maintain nesting territories and reduce or mitigate mine-related impacts on nesting raptors prior to, during, and following active mining.

Tolerances of Raptors to Blasting and Construction Activity on the Susquehanna River during the Development of the Holtwood Hydroelectric Expansion

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Over the past 10 years, the area around PPL's Holtwood Hydroelectric Project (FERC License No. 1881) has become the home for multiple breeding pairs of Bald Eagles (*Haliaeetus leucocephalus*), Osprey (*Pandion haliaetus*), as well as a currently non-breeding pair of Peregrine Falcon (*Falco peregrinus*). PPL has begun

construction to increase the capacity of the Holtwood facility from 107.2 MW to 195.5 MW. This redevelopment requires the construction of an additional powerhouse plus excavations and modifications of the river channel. The Bald Eagle is a threatened species in Pennsylvania and is also protected federally by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The United States Fish and Wildlife developed the National Bald Eagle Management Guidelines in May 2007 to inform the public about how to protect Bald Eagle from disturbance. The Pennsylvania Game Commission also provided guidance about how to protect the state endangered Peregrine Falcon and threatened Osprey from disturbance during construction. In combination, the initial guidance from each agency made the three year construction project economically infeasible. However, PPL worked with these agencies to develop a site specific adaptive management plan that includes seasonal construction restrictions, phased construction, and limits on the decibels produced during blasting. PPL monitors one Eagle nest during each blast, and makes regular observations of another Eagle nest, three Osprey nests, and one potential Peregrine falcon nest to assess if the construction is disturbing these protected raptors. The first season of monitoring has proven that the experimental plan to protect each of these raptors has been successful. The results from the monitoring provide new information regarding the tolerances each of these raptors has for human disturbance.

Pre- and Post-Construction Evaluation of Collision Potential for Fall Migrating Raptors with a Transmission Line in Central Washington

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We monitored passage rates (migrants/hr) and patterns (corridors and altitude) of fall migrating raptors using both visual and radar observations to assess raptor collision potential along 14 spans of a transmission line in 2005 (pre-construction) and 2007 (post-construction). In both years, observations were made from late August through mid-October during peak fall raptor migration. Numbers of migrating raptors recorded were similar for pre- (1,472) and post- (951) construction surveys. Passage rates recorded from visual observations were not significantly different ($t = 1.8$, $p = 0.07$) between pre- and post-construction years (5.6 and 4.7 migrants/hr, respectively). Radar observed passage rates were much greater (9.9 and 7.9 events/hr, during pre- and post-construction years respectively), which includes unconfirmed crossings which may or may not have been raptors. The proportion of raptors crossing each of the transmission line spans (corridors) examined was significantly different than expected based on span length during both pre- ($\chi^2 = 580$, $p < 0.00$) and post-construction ($\chi^2 = 99$, $p < 0.001$) years. Likewise, radar observations documented differences in corridors used between spans in both years. To assess the risk of collision it was important to monitor the height of migrating raptors in relation to pole height ($\square = 30.3$ m). During pre-construction, only 4.7% of migrating raptors crossed the line below estimated pole-top height, however, 51.7% of these occurred at two spans. The transmission line was constructed with bird flight diverters on seven of the 14 spans surveyed where raptor migration rates were higher than expected. During post-construction surveys, no collisions were observed and only 3.8% of migrating raptors were observed crossing below existing transmission line wires. The altitude ($\square = 251.0$ m) at which migrating raptors crossed the transmission line greatly reduced their potential for collision.

A Retrospective Assessment of the Effects of Oil and Gas Field Activities on Nesting Raptors near Price, Utah and Rawlins, Wyoming

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We assessed the potential impacts of past oil and gas development activities on nesting Golden Eagles (*Aquila chrysaetos*), Ferruginous Hawks (*Buteo regalis*), Red-tailed Hawks (*B. jamaicensis*), and Prairie Falcons (*Falco mexicanus*) on lands managed primarily by the Bureau of Land Management (BLM). We used state oil and gas records, BLM nest records from near Price, Utah (1998–2006) and Rawlins, Wyoming (1978–2006), and vegetation and climatic data to model relationships between development and nesting activity while controlling for the potential influence of environmental covariates. The number of oil and gas wells increased by ≥ 2.6 times in the 2 study areas with apparent effects on raptor breeding activity. We found more consistent evidence of negative impacts in the Rawlins study area, with all 4 focal species exhibiting negative impacts from development occurring within either a 0.8 or 2.0-km radius of the territory nest cluster. Our results also suggested that oil and gas development produced negative effects in both study areas for species with the largest sample sizes (i.e., Price and Rawlins Golden Eagles and Rawlins Ferruginous Hawks). We suggest that current BLM 0.8-km-radius nesting season protective buffers should not be reduced, as Price Golden Eagles and Rawlins Ferruginous Hawks, Red-tailed Hawks, and Prairie Falcons exhibited negative relationships with development at this scale. Further, existing buffers may have been insufficient to avoid negative impacts to some species, as we also detected negative relationships for Price and Rawlins Golden Eagles and Rawlins Prairie Falcons at the 2.0-km spatial scale. We also briefly highlight our assessment of the ability



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of artificial nesting structures to mitigate oil and gas disturbance for nesting Ferruginous Hawks in the Rawlins study area and our development of detailed recommendations for future monitoring programs aimed at evaluating the impacts of land use change on nesting raptors.

Use of Camera Traps to Investigate Cape Vulture (*Gyps coprotheres*) Roosting Behavior on Power Lines in South Africa

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Large numbers of Cape Vultures roost regularly on the support towers of two adjacent 400 kilovolt (400,000 volts) transmission lines near Krugersdorp in South Africa. Repeated mortalities and injury of birds, suspected to be due to collision with the overhead cables, have been recorded at the site since 1996. Implementation of effective solutions in these circumstances is not possible without a full understanding of the exact mechanism through which birds are killed at this site. Key questions which will inform the design of appropriate mitigation measures include: time of entry and exit to the roost by birds; predominant angle of approach and departure from roost; bird behavior whilst on the roost; and preferred roost positions on the towers. The identification of the cables which pose the greatest collision risk is also critical. Digital motion sensor camera traps were installed on three towers in January 2010 in order to investigate these factors further. To date, two downloads of data have been obtained. Initial findings are that birds often enter the roost well after dark, due primarily to late feeding at a nearby vulture restaurant (managed feeding site). Entry to the roost towers is predominantly from the east. Birds often circle the roost at close proximity well after dark, presumably as part of the social interaction of this gregarious species. Birds also appear to be disturbed at intervals through the night, leaving, circling and re-entering the roost. All of these factors place the birds at greater risk of collision with the cables. It appears that the thin,

highest cable, known as the earth wire or shield wire poses the greatest collision risk, with several near misses being recorded by the cameras. Data collection will continue through to August 2010 to capture winter behavior at this roost.

Best Management Practices for Wind Energy in Areas with Golden Eagles (*Aquila chrysaetos*) in Wyoming

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Golden eagles inhabit areas in Wyoming that are rich in wind-energy resources. Golden eagles are susceptible to collision mortality with the blades of wind turbines due to their behaviors, such as long foraging flights at altitudes in the blades "zone of risk." Best management practices for avoiding eagle fatalities primarily involves turbine siting that is based on extensive pre-construction avian and habitat surveys. However, adherence to U.S. Fish and Wildlife Service's pre-construction survey and siting guidance is voluntary. Research is urgently needed to thoroughly understand eagle use patterns and habitat relationships in Wyoming and to refine turbine siting guidance as well as encourage compliance. Furthermore, studies to evaluate methods for diverting eagles and other raptors, such as Ferruginous hawks (*Buteo regalis*) which are also at risk, from collisions with wind turbines is central to post construction adaptive management. Currently, there are approximately 1000 operating wind turbines in Wyoming. It is anticipated that another 1000 will be constructed in the next two years. Not all wind energy development results in high rates of eagle mortality, however, high fatality rates have been noted. In one geographic region of Wyoming, where concentrations of golden eagles over-winter, mortality rates have approached one eagle per 39 turbines per year and in another area, with an abundant prey base, mortality rates were one eagle per 13 turbines per year. Eagle fatalities occurred throughout the year; however most mortality occurred in the months of April and



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May, a period of time when eagles in Wyoming are tending nests.

Long-term Strategies and Information Needs for Conserving Golden Eagles (*Aquila chrysaetos*) and Bald Eagles (*Haliaeetus leucocephalus*) in an Energy Development Environment

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Surprisingly, little published literature on Golden Eagles can be used to directly inform decisions on avoiding or minimizing negative impacts of anthropogenic activities on the species. For example, accurate buffer distances for protecting nest sites and breeding territories from human activities often are neither published nor supported by data and decision makers must rely on white papers and gray literature, which were not intended as national guidance for emerging forms of energy development. Most buffers for Golden Eagles and Bald Eagles address disturbance at nest sites and breeding territories but do not address potential mortality from infrastructure such as wind turbines, potential impacts on floaters and resident sub-adults or wintering or migrating eagles. In addition, buffers are not designed to mitigate cumulative adverse effects from habitat fragmentation, nor do they mitigate negative impacts to the source population from which wintering or migrant eagles arise. This overview details critical information needs and possible approaches for developing scientifically defensible mitigation measures for impacts to Golden Eagles and Bald Eagles.





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The Future of Raptor Banding

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Hans Christian Cornelius Mortensen is credited as being the first to band large numbers of birds (Common Starlings [*Sturnus vulgaris*]) with uniquely numbered and return-addressed aluminum bands. Much has happened in the field of avian movement ecology since Mortensen's initial efforts in 1899. The first published study of raptor migration based on banding appeared in *The Journal für Ornithologie* in 1913. The U. S. Bird Banding Lab opened in 1920, and by early 2010, 55 species of birds of prey had been banded or "air banded" in the U. S. and Canada. The historical scope of banding enables researchers to track temporal as well as spatial differences and similarities in the seasonal and other movements of many raptors. It also provides a useful tool in the ecologist's "toolkit" to study the movements and ecological consequences of these movements in birds of prey. Most importantly, color banding, wing-tagging, conventional radio tracking, satellite tracking, geolocating data loggers, and stable-isotope analyses, now allow researchers to answer questions that were once beyond reach. The presentations in this symposium summarize these advances and offer a view of the future for studies of raptor movement ecology. Here we summarize these advances and offer suggestions regarding what questions remain and how we can move to answer them. The extent to which raptor banding will continue to make contributions to understanding the movement ecology of raptors will depend upon those who use it as an effective tool, either on its own or in conjunction with other tools.

Summary of Raptor Banding Records at the Bird Banding Lab

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The USGS Bird Banding Laboratory has the responsibility of storing and managing all bird banding data from North America since the start of the banding program in 1902. These files contain more than 70 million records. Data are more accessible (electronic) starting in 1960, representing 61 million birds. Of these, 1.7 million represent raptors, 1.26 million being diurnal raptors and 427,000 being owls. As expected, the more commonly occurring species are the more commonly banded. Sharp-shinned Hawk (*Accipiter striatus*), Red-tailed Hawk (*Buteo jamaicensis*), and American Kestrel (*Falco sparverius*) are the most commonly banded diurnal raptors. Among owls, Northern Saw-whet Owl (*Aegolius acadicus*) is by far the most commonly banded, thanks to Project OwlNet, followed by Barn Owl (*Tyto alba*) and Great Horned Owl (*Bubo virginianus*). A large majority of raptor banding has taken place at migration monitoring stations. Although banding data are most interesting when associated with subsequent encounters, much interesting distributional and migration information can be "mined" from the banding database. Because we store information regarding the status of banded birds, we can demonstrate the increases or decreases over time in the use of auxiliary markers such as coded leg bands, geolocators, transmitters, etc.

The Cape May Raptor Banding Project: 40 Years of Conservation through Banding

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Nearly 132,000 diurnal raptors of 16 species have been captured and banded during fall migration by the Cape May Raptor Banding Project at Cape May, New Jersey, USA since 1967. Slightly more than half were Sharp-shinned Hawks (*Accipiter striatus*). Cooper's Hawk (*A. cooperii*) and American



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Kestrel (*Falco sparverius*) together constituted another 30% of the total. Approximately 90% of captures were aged by plumage as juveniles (hatch year), while fewer than 6% were definitively aged as full adults (after second year). Sex ratios were seldom 1:1, and in some species were nearly 2:1. Within most species, seasonal timing of captures differed by age class, with juveniles peaking before adults. Long term trends in capture numbers tracked similar trends in migration counts at Cape May. About 2,800 banded raptors (2%) were encountered subsequently at other locations throughout the Americas at all times of the year. Encounter frequencies differed from capture rates in many species. Sex ratios of encounters also varied from those of captures. Mapping of encounter locations indicates possible seasonal differences in migration pathways, and probable differences between sexes in breeding and wintering ranges, for some species. Of encounters listing a specific cause of mortality, collisions with stationary objects or moving vehicles accounted for about 30% each. Longevity records for raptors banded at Cape May include 24 yr for Red-tailed Hawk, 15 yr for Northern Harrier (*Circus cyaneus*), and 14 yr for Cooper's Hawk and Broad-winged Hawk (*B. platypterus*). Morphometric data was collected for thousands of individuals; comparison with data from other banding stations shows regional variations in some measurements. Collaborators have used birds captured at Cape May to study parasites, contaminants, taxonomy and other subjects. Thousands of people have attended educational programs that featured banded raptors. Issues impacting on-going program operations include landowner relationships and bander recruitment and retention.

A 38-year Summary of Raptor Banding at Hawk Ridge, Duluth, Minnesota, USA

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Consistent banding of raptors at Hawk Ridge was initiated in 1972 and has continued for 38 years to the present. A total of 99,505 raptors or 2,619 per year have been banded at Hawk Ridge including 23 different species. The majority of birds banded were Sharp-shinned Hawks (*Accipiter striatus*) (60,147) and Northern Saw-whet Owls (*Aegolius acadicus*) (20,676). Among the totals also include 8,103 Northern Goshawks (*Accipiter gentilis*), six Gyrfalcons (*Falco rusticolus*), 2,243 Long-eared Owls (*Asio otus*), and 92 Boreal Owls (*Aegolius funereus*). Three species have had a substantial number of recoveries and returns, these include 459 Northern Saw-whet Owls (327 recoveries and 132 returns), 381 Sharp-shinned Hawks (320 recoveries and 61 returns), and 278 Northern Goshawk (228 recoveries and 50 returns). Our summary will focus on the patterns of recovery for these species and potential causes for annual variation in number of birds banded over the past 38 years compared with those counted at Hawk Ridge. Despite consistent effort, the last six years (2004-2009) were six of the seven lowest totals banded over the 38-year period; primarily due to the low number of Sharp-shinned Hawks banded.

Raptor Banding and the Migration Geography and Ecology of Raptors

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Band recovery data is an abundant and useful resource for enhancing our understanding migration geography and ecology in raptors. To date more than 63,000 raptor band recoveries dating from the 1920s have been cataloged by the USGS Bird Banding Laboratory, with more than four thousand records from some species. These data are useful to raptor monitoring and conservation by linking



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migration watch sites to the breeding and wintering catchment areas. They may also provide insight into the geography and ecology of North American species. A comparison of Sharp-shinned Hawk (*Accipiter striatus*) band recoveries among flyways ($n = 4762$) reveals there is overlap in flyway ranges during the non-breeding season but a distinct east to west separation as well. For example, Atlantic-flyway and Great Lakes banded birds overlap in Florida and Georgia during the non-breeding season and in southern Quebec in the breeding season but are otherwise segregated longitudinally. The median wintering latitudes of Sharp-shinned Hawks banded in mid-west and western flyways lies farther south than birds trapped in Appalachian or Atlantic flyways suggesting eastern birds maybe more constrained by water barriers. Cooper's Hawks (*Accipiter cooperii*) banded during the breeding season north of 40° latitude wintered farther north than birds breeding south of 40° latitude line lending support to a possible chain migration pattern in this species. More northern breeding female American Kestrels (*Falco sparverius*) ($\geq 50^\circ$) were recovered farther south in winter than females that bred in middle latitudes ($\leq 49^\circ$ - 30°), suggesting a possible leap-frog pattern for females, whereas male kestrels showed no difference in mean non-breeding latitude by breeding origin. Band-recoveries of these three commonly-banded raptors compared across flyways and latitudes suggest differences in movement ecology and geography dependent on nesting origin, sex, and species. Further exploration of banding data by researchers may enhance our understanding of North American raptor ecology.

A Spatial Temporal Assessment from Three Decades of Raptor Banding throughout the American West

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A goal of HawkWatch International (HWI) is to monitor raptor populations over time and space. Mark-recapture banding studies have been incorporated at a number of sites to augment monitoring efforts and to gain a deeper understanding of raptor migratory behavior, movement patterns, and ecology. To assist with these tracking efforts, HWI has incorporated technological advancements utilizing satellite telemetry, GIS-based spatial mapping, and stable hydrogen isotopic and genetic analyses. Objectives of our banding efforts have been to: identify and compare species and site specific migratory behavior and movement patterns; identify patterns of migratory connectivity; and identify causes and locations of raptor mortalities. Mapping of band recoveries, along with satellite telemetry and stable isotopic analyses have identified and characterized species-specific movement patterns among Northern Goshawks (*Accipiter gentilis*), Golden Eagles (*Aquila chrysaetos*), Sharp-shinned Hawks (*Accipiter striatus*), and Red-tailed Hawks (*Buteo jamaicensis*). More interestingly, mapping of all recoveries together has revealed three major migratory flyways used by raptors as they migrate north and south through the western U.S.: the Pacific Coast, Intermountain, and Rocky Mountain. Genetic analyses has identified locations of Red-tailed Hawk western sub-populations, directional gene flow, as well as identified potential geographic, habitat, and behavior barriers to gene flow. Recovery and satellite telemetry data have also been used to identify sources of mortality. These results, along with more detailed site-specific mapping of band recovery data, will be reported to further assess patterns of migratory connectivity to compare both within and among the three main migratory flyways.

25 Years of Raptor Banding at the Marin Headlands: a Review of Collaborations

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From 1983 through 2009, Golden Gate Raptor Observatory volunteers banded 30,960 raptors of fifteen species at the Marin Headlands, north of San Francisco, California. Most commonly banded were Sharp-shinned Hawks (*Accipiter striatus*), Cooper's Hawks (*Accipiter cooperi*), Red-tailed Hawks (*Buteo jamaicensis*), and American Kestrels (*Falco sparverius*). 1054 band recoveries have been reported, a recovery rate of 3.4%. Encounters were frequent in the hills and valleys of the Coast Range with smaller numbers in California's Sacramento Valley. Few encounters occurred within the Sierra Nevada. Recoveries extend from southern Baja California to northern British Columbia and from the Farallones Islands to Jerome, ID. Research efforts have utilized banding, radio telemetry, genetic, morphological, isotopic, and serological methodologies. Banding efforts have resulted in documentation of a prolonged autumn presence of Broad-winged (*Buteo platypterus*) and Swainson's (*Buteo swainsoni*) hawks in central California and a single Eurasian Kestrel (*Falco tinnunculus*), have established longevity records for Cooper's Hawks (14+ and 20 years), and lead to the successful development of a mechanical lure for raptor trapping. Radio telemetry has demonstrated long-distance multidirectional (north, south, and east) movement of individuals in the sampled population. Genetic studies have illustrated the presence of distinct Red-tailed Hawk populations at different times during the migration, led to the development of sexing methods for Red-tailed and Red-shouldered (*Buteo lineatus*) hawks, revealed east-west population divisions in Sharp-shinned and Red-shouldered hawks, and led to the identification of distinct *Leucocytozoan* ssp. in Cooper's, Red-tailed, and Red-shouldered hawks. Morphological work has revealed that Pacific flyway Cooper's and Red-tailed hawks are smaller than eastern populations, and serological studies indicate that prevalence of West Nile virus antibodies varies among the sampled species. Ongoing work addresses molt patterns, mortality, and

age structure of the migrating population of Red-tailed Hawks and migration timing and movements across multiple species.

Have You Ever Gotten a Text Message from a Vulture?: Using GSM-GPS Transmitters to Assess Movement, Habitat Use, and Mortality in African Vultures

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GSM-GPS transmitters offer a cheap alternative to traditional satellite telemetry and provide similar insights to species' movement ecology. Preliminary findings from GSM-GPS transmitters attached to three species of vulture in Masai Mara National Reserve, Kenya suggest significant differences between species in habitat use and movement ecology. African white-backed vultures (*Gyps africanus*) had the largest home ranges, with a single individual using an area of 188,000 km². Rüppell's vultures (*Gyps rueppellii*) had larger day ranges and traveled at higher altitudes and greater speeds than the African white-backed or Lappet-faced vultures (*Torgos tracheliotos*). Movement and habitat use of all three species was heavily influenced by the season with African white-backed and Rüppell's vultures spending more time outside of protected areas during the wet season. African white-backed vultures experienced the greatest changes in day range size between the wet and dry season. All three species altered behavior in relation to habitat, flying higher and faster when outside of protected areas, suggesting that vultures aren't actively searching when outside reserves. On average, Rüppell's vultures spend more time outside of protected areas, increasing their susceptibility to poisoning. Deaths of tagged vultures provide evidence of high annual mortality most likely due to poisoning. Findings suggest that human activities such as poisoning and habitat destruction heavily influence vulture movement and survival.



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Summary of Raptor Encounter Records at the Bird Banding Lab

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Since the inception of the North American Bird Banding program through 2008, the United States Geological Survey Bird Banding Laboratory (USGS BBL) has received approximately 54,000 encounter reports of banded raptors across 52 species, excluding local recaptures and band only reports. A summary of the USGS BBL encounter database shows that between 1960 and 2008 banded raptors were encountered at a rate of approximately 2.90%. Reporting rates have varied over the years, however after 1996 with the inception of the 1-800 toll free number, the USGS BBL has regularly processed 1500-2000 encounter reports of raptors annually.

Raptors with the highest reporting rates are Bald Eagle (*Haliaeetus leucocephalus*) at 14.0% of the banding records, Golden Eagle (*Aquila chrysaetos*) at 8.3%, Great Horned Owl (*Bubo virginianus*) at 8.0%, Snowy Owl (*Nyctea scandiaca*) at 7.6%, and Peregrine Falcon (*Falco peregrinus*) at 7.1%.

Approximately 17.72% of encounter records are birds marked with auxiliary markers, and of these, only 15.2% are resightings. With advances in marking technology, reencounters with living marked raptors may begin to greatly exceed other methods of recovery, and the potential exists that sizable numbers of these reencounters will not be reported to the USGS BBL.

Comparing Sources of Mortality and Extent of the Wintering Range of Migratory Juvenile Golden Eagles (*Aquila chrysaetos*) from Interior Alaska as Derived from Banding and Satellite Telemetry Data

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Documenting year-round movements of wide-ranging birds is essential for identifying the factors that influence their survival and the areas they use during their lives, and for developing effective conservation strategies. This is especially true for migratory species from northern latitudes that spend much of their lives away from their breeding areas. Golden Eagles raised in the northern latitudes of northwestern North America are usually migratory, but little is known about their movements or survival. From 1988 to 2003, I banded 305 Golden Eagle nestlings in and near Denali National Park and Preserve in interior Alaska. I also deployed 90-gram satellite transmitters on 43 of these eagles just before they fledged in 1997 and 1999. Ten of the 305 banded eagles (3%) were encountered after the banding event, including 5 eagles encountered within 1 year of banding. All encounters of banded eagles were >800 km from the banding location outside Alaska during winter or the migration season. Of the five eagles encountered within 1 year of banding, all were found <2 km from a road including two that were electrocuted, one that was shot, and one that was found alive in a turkey pen. The band encounters were made from southern Alberta to north central Mexico. In contrast, all of the recoveries of dead radio-tagged eagles (15) were made >5 km from a road and post-mortem necropsy indicated that all but one of these eagles died from starvation. The winter range of all radio-tagged eagles extended from central Alberta to southeastern New Mexico. Although the sample sizes are small, these results demonstrate how different marking and tracking tools can produce different results regarding the sources of mortality and extent of the winter range of this species.

Changes in the Reasons Why People Have Reported Raptor Encounters to the BBL Over the Decades

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Banding data are usually associated with information collected when a bird is banded and inferences on movement patterns obtained when banded birds are recaptured, re-sighted, or found dead. Other information obtained when banded birds are encountered can provide insights into the conservation of migratory raptor populations. For example, the how obtained codes refer to how the person found the banded bird. These codes include common reasons like found dead, shot, captured injured bird, caught due to striking an object, or more obscure reasons like "caught" by weather conditions. While encounter reporting to the Bird Banding Lab have generally increased over time, temporal patterns to changes in the how obtained codes reflect anthropogenic influences on raptor populations. Some general trends during recent decades include a decline in reports of shot raptors and an increase in reports due to striking motorized vehicles and stationary objects. When placed in the context of known population trends, the temporal and geographic patterns in the use of these codes could reveal important conservation issues that should be brought to the attention of management agencies.

Peregrine Falcons on Coastal Beaches of Washington: Banding and Surveys 1995-2010

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We captured and color-banded 141 Peregrine Falcons (*Falco peregrinus*) during 808 surveys on three coastal beaches in Washington in all seasons between 1995 and 2010. We captured 88 females and 53 males; 71.6% ($N = 105$) were < 1 yr old and 28.4% ($N = 36$) were ≥ 1 yr old. One-hundred-and-ten of the falcons appeared to be *F. p. pealei*, the northeastern Pacific coastal subspecies. Others had plumage

characteristics consistent with *F.p. anatum* ($N = 4$), *F. p. tundrius* ($N = 4$) or showed intermediate characteristics ($N = 19$). Fifty-three percent ($N = 75$) of the marked peregrines were re-sighted alive, and 6.4% ($N = 9$) were recovered dead. Fifty-one peregrines showed beach fidelity and > 50% of these showed site fidelity. Marked individuals were re-sighted as far as 1019 km north to Langara Island, British Columbia, 1679 km south to the Salton Sea, California and 83 km east to the Kennedy Creek estuary near Shelton, Washington. We collected feather and blood samples from many of the falcons; these samples may be used in stable isotope or genetic analyses to better understand the natal origins and subspecies of our banded birds. Future banding studies along coastal Washington could include radio-telemetry which then could be used in a multi-faceted project on space use by falcons relative to the distribution and abundance of prey as a function of tidal stage; territory size or shape; age, sex, body mass and subspecies; site fidelity and survival. Information from this type of project might provide insight into the quality of areas used by peregrines. Additionally, data from our study and other ongoing banding programs may inform models that in turn inform decisions on the sustainable take of falcons for falconry purposes.

Patagial Tag/Transmitters for Condors and Other Large Vultures

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When it became known in the late 70s that metal or plastic leg bands could cause injury to or loss of legs in cathartid vultures due to fecal matter build-up between the leg and the band, we modified the wrap around wing tags, then being used for bird identification at a distance, to a tag permanently attached to the patagium or wing web of the bird. Tests on 33 black and turkey vultures indicated that young birds would physically and behaviorally tolerate the 4.5-inch tags



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and that the painted vinyl was sufficiently visible and durable to be useful for studies on and management of these species. The opportunity arose to test the efficacy of patagial tags on Andean condors (*Vultur gryphus*) in Peru. With a trained male Andean condor, I was able to inspect at relatively close range the behavior of the tag as the bird repeatedly flew past at varying cliffside altitudes to 1,000 feet. Every effort was made to reduce adverse aerodynamic effects of the tag from drag by varying the size and tag material thickness. Drag was determined by the degree of tag conformation to the wing and the tag size that that produced the least amount of tag flutter. A small lightweight VHF transmitter was incorporated into the tag after issues resulting in mortalities developed while using backpack harnesses. Using the same design, 50-gram GPS transmitters were later successfully incorporated into the patagial tag attachment and are now being used in both Andean and California condor (*Gymnogyps californianus*) programs.

Use of GPS-Satellite Transmitters to Inform Management of Bald Eagle Roosts Within the Upper Chesapeake Bay, USA

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Satellite transmitter technology has become a prominent tool in raptor research providing dispersal, migration, and other behavioral data vital for making informed management decisions. Despite the fact that communal roosts of the Bald Eagle (*Haliaeetus leucocephalus*) are protected in the United States under the Bald and Golden Eagle Protection Act, we have little systematic information on eagle roosts to develop a policy framework that governs day to day management decisions for the species. We used GPS-PTT satellite transmitters to assess roosting behavior and delineate the boundaries of communal roosts within the upper Chesapeake Bay. GPS-PTT satellite transmitters were deployed during 2007-2009 on a cross-section of Bald

Eagles ($n = 63$) that were programmed to record nocturnal roost locations ($n = 10,321$). A large number (2,800) of roost locations were not associated with communal roosts and were assumed to reflect solitary roosting behavior. Remaining locations were clustered within 170 communal roosts that varied in area (0.04-20.13 ha), relative use (5-755 roost nights), and the number of transmitted birds supported (2-35). The number of communal roosts within the study area has grown 10 fold over the past 20 years, reflecting the growth of source populations and presumably eagle use of the area. Management policy should attempt to strike a balance between species protection and social burden. From a practical standpoint, solitary roosts are numerous, cover the entire study area and are beyond management control. Small communal roosts are also widespread and account for a relatively small portion of roosting activity but a disproportionately large amount of management buffers. Within the roost network delineated here, applying a management threshold of 0.5% of roosting activity would reduce the burden to both managers and landowners by more than 75% with only minimal impact to eagles.

Geolocators and Raptors: Advantages and Limitations of a New Tracking Technology.

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In recent years, the use of light-sensitive geolocators to track bird movements has exploded, including a number of studies deploying them with both diurnal and nocturnal raptors. These light-weight data loggers offer a relatively low cost per unit, long tracking times (>2 yr) and can be used on species too small for satellite telemetry. However, geolocators also present some significant limitations - they must be recovered from the subject, and the resulting locations are at a fairly crude scale of resolution, limiting their use on short- and medium-distance migrants. Furthermore,



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some studies have found that one common attachment method may present serious risks to birds. Researchers considering the use of geolocators should carefully assess whether this new technology is right for their species, conditions and study goals.





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Occupation of a Vacant Nest Site by a Second-year Breeding Northern Goshawk (*Accipiter gentilis*)

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Beginning in 2002, we regularly checked nest sites of a Northern Goshawk breeding population in the vicinity of southern Berlin, Germany, and ringed the chicks therein. We recorded fluctuations in nest occupation, and tentatively attributed some nest failures to frequent acts of illegal persecution by local people. Although we lack incontrovertible proof of illegal persecution, we do have suggestive evidence. In June 2007, the first author and his colleague Richard Klauß found a dead Domestic Pigeon (*Columba palumbus forma domestica*) near each of two breeding sites 178 m apart. These pigeons were only a few meters from respective nesting trees, and had been apparently been deposited as bait intended to expose breeding Northern Goshawks to pesticides. Each of these nests failed in 2007. On 19 June 2008, we found a ringed second-year Northern Goshawk in one of these nests. The bird, a female, came from the Berlin area, had been ringed as one of three siblings on 03 June 2007, and successfully raised one nestling. The ringed bird's natal site and breeding site were separated 3 km. In previous investigations in both 2003 and 2004, we also found a single nestling, although in 1997 we found four eggs in the nest. In 2010, breeding failed due to a visit to the nest by a Beech Marten (*Martes foina*), suggesting an alternative explanation for low fledgling success. Our results show that vacant nest sites can be colonized by second-year females if older breeding birds disappear (presumably having fallen to illegal persecution), provided that recruitment from neighbouring territories is possible.

Perspectives on the Interactions between Old World Vultures and Human Societies

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Globally, vultures are one of the fastest declining groups of birds. A variety of interactions occur between Old World vultures and human societies, many of which have negative consequences for vultures. Changes in animal husbandry practices in Europe, Asia, and Africa have led to drastic declines in Old World vulture populations. Secondary poisoning of avian scavengers, typically associated with human-wildlife conflict and directed at mammalian predators, has had a major impact on vultures throughout the African continent. Possible conservation solutions, such as vulture restaurants, increasing public awareness, and implementing new animal husbandry practices, might be effective in alleviating human-mediated impacts to Old World vultures.

Contaminants in Bald Eagle (*Haliaeetus leucocephalus*) Nestlings on the Mississippi and St. Croix Rivers

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From 2006 through 2008 we assessed levels of targeted environmental contaminants in 162 Bald Eagle nestlings on the Mississippi and St. Croix Rivers. Nestlings were sampled for six contaminants: total mercury, lead, DDT (and metabolites DDE and DDD), total PCBs (75 congeners), total PBDEs (9 congeners), and total PFCs (16 telomers). The study areas had ≥ 1.5 young per occupied territory, considered the threshold for a healthy bald eagle population. Contaminant levels varied between study areas and years. The geometric mean mercury levels in feathers ranged from 2.67 ug/g on pools 3 and 4 of the Mississippi River in 2008 to 7.88 ug/g on the upper St. Croix River in 2006. Mean lead



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levels in feathers were highest on the lower St. Croix River in 2006 (0.99 ug/g). We found DDT, which was banned in North America 37 years ago, in one nestling from the Mississippi River and DDE in all nestlings sampled. PCBs were lowest on the upper St. Croix River in 2006 (\bar{X} = 10.01 ug/L) and highest on the lower St. Croix River in 2006 (\bar{X} = 136.06 ug/L). Generally, spatial patterns of polybrominated diphenyl ethers (PBDEs), a group of chemicals of increasing concern, were similar to PCBs across the study areas. Perfluorinated compounds (PFCs), another group of chemicals of increasing concern, were found in all samples and the primary telomer was PFOS (64% of all samples by volume). In 2006 we found PFOS at very high levels in nestlings on the lower St Croix River (\bar{X} = 1550.27 ug/L) and on the Mississippi River (\bar{X} = 1234.17 ug/L). Our results show that eagle productivity is above thresholds for concern, yet contaminants continue to persist in the food chain, including those of more recent concern.

Effects of Off-Highway Recreational Vehicles on Nesting Golden Eagles (*Aquila chrysaetos*) in Southwestern Idaho

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Declining Golden Eagle populations and increasing human use of Golden Eagle habitat have raised concerns about the effects of off-highway recreational vehicles (OHV's) on Golden Eagles. Past research has indicated that nesting Golden Eagles are sensitive to several types of activities near their nesting sites. We compared nesting success and productivity of Golden Eagle territories exposed to high levels of OHV use with territories in adjacent areas with less motorized recreational use. We also evaluated trends in Golden Eagle reproduction in both areas in the years before and after dramatic increases in recreational use. Preliminary analyses

suggest that Golden Eagle nesting territories exposed to high levels of OHV use were less productive than territories in surrounding areas. Declines in productivity at territories affected by motorized recreation occurred during the same time period that motorized recreational activity increased. Golden Eagle pairs in the most intensively used areas appear to have abandoned their territories, whereas productivity in adjacent areas with limited motorized recreation has remained relatively stable. We discuss implications for managers.

Traditional Native American Culture in Conflict with Conservation, Public Perspective and the Law

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Sia: The Comanche Nation Ethno-Ornithological Initiative is founded on over four decades of expertise derived from a unique history of indigenous cultural conservation. Deeply rooted in Numunuh (Comanche) traditional culture, founding Sia co-director, William Voelker is also the first Native American to hold permits from the USFWS for the care and breeding of Bald and Golden Eagles and the only Native American to have breed both species in captivity. Sia brings a lifestyle of historically based traditions together with a sound background in taxonomy and scientific protocol to address the current issues pertaining to Native American use, acquisition and distribution of eagle and non-eagle migratory bird feathers. Sia has secured several never before issued authorizations pertinent to the Native American relationship with avian species of cultural significance. Most noteworthy is the recently issued Memorandum of Agreement and associated permit establishing Sia as the first Native American feather repository for non-eagle, migratory birds. The Sia Essential Species Repository is established as a two year pilot program to assist in providing legally acquired feathers to any and all of the federally recognized tribes. This represents a unique partnership between a tribal entity and the USFWS



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which heralds a new day in Native American/Federal Governmental relations. The political nuances, acquisition partnerships as well as the scientific protocol for individual feather authentication developed by Sia, significantly raises the standard for Native Americans by Native Americans in a way that stands to eliminate much of the illegal and unethical practices that assault our wild avian resource.

Quantifying and Reducing Bird-Aircraft Strike Hazard (BASH) Risk Associated with Breeding and Migrating Osprey (*Pandion haliaetus*)

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The Osprey is one of the most widely distributed and well studied bird species of the Northern Hemisphere; however, little is known about their potential impacts to military flight operations. A Department of Defense Legacy Natural Resources Program-funded multi-agency research project examining the strike-risk posed by breeding and migrating Osprey was initiated in 2006. During the 2006 and 2007 nesting seasons, 13 adult Ospreys were live-captured, fitted with GPS-capable satellite transmitters, and released from selected nest locations near Langley Air Force Base, Virginia (U.S.A.), in the Mid-Atlantic Chesapeake Bay Region. We monitored satellite-tagged Osprey movement patterns of fitted Osprey by tracking them during breeding, migration, and wintering periods. Movement and location information collected from breeding Osprey was cross referenced to military flying operations associated with Langley Air Force Base to assess the risk breeding Osprey pose to military aircraft near the airfield. In addition, migratory patterns of Osprey were evaluated to assess the risk migrating Osprey to military aircraft

operations along the Eastern seaboard. Incorporation and integration of Osprey movement information (e.g., timing, travel routes) into military flight mission planning systems will increase pilot awareness of potential Osprey-aircraft strikes during critical time periods and will allow for military flight operations to occur at times and locations that minimize the risk of Osprey-aircraft collisions.

Eagle Economics: Estimating the Social Burden of Bald Eagle Recovery in the Lower Chesapeake Bay

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Because the future of many endangered species will be determined on private lands, the conflict between private property rights and species protection has become a contentious theme in the development of environmental policies. How to strike a balance between benefits to target species and the burden imposed on society has become one of the most complex problems in the recovery of many species. The Bald Eagle (*Haliaeetus leucocephalus*) population in the lower Chesapeake Bay has increased from 20 pairs in 1970 to 560 pairs in 2007. More than 75% of pairs reside on private lands and are managed using a combination of protective buffers and land-use restrictions. Here I quantify the amount of private land falling under management guidelines in Virginia and use tax assessments to estimate the collective value of these lands (1977-2007) as an indication of the burden borne by society for eagle protection. During the study period lands falling under Bald Eagle management guidelines increased exponentially with an average doubling time of 7 years corresponding to an average annual increase of 10.5%. By 2007, the collective value of lands within management buffers was more than 4.5 billion dollars. In just 30 years, the value of lands under restrictions increased by 360 fold. This increase reflects both the recovery of the



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nesting population and a rapid rise in real estate values. Spatial variation in Bald Eagle colonization rates has resulted in a greater than 6-fold difference in breeding density across a steep salinity gradient such that rural, low saline reaches support the core of the breeding population. The value of land varies by more than 300 fold across the area with the most valuable lands occurring within the most developed locations. These relationships result in a large portion of the social burden being borne by relatively few landowners.

The New U.S. Fish and Wildlife Service Eagle Act Permit as a Conservation Tool

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Managing interactions between humans and eagles to benefit or cause no harm to either or both species is a persistent challenge. Failure to properly manage can be fatal to both in some cases, such as at airports. Extant and proposed alternative energy projects throughout the United States have high potential to adversely impact resident and non-resident Golden Eagles (*Aquila chrysaetos*) and Bald Eagles (*Haliaeetus leucocephalus*) through mortality, injury, disturbance, displacement, and habitat loss. Both species also are increasingly subject to other development pressures such as recreational activities and residential growth with its associated infrastructure. The USFWS recently released two rules plus guidance on responsibilities of action agencies, project proponents, consultants, and raptor biologists in achieving short and long term protection of Golden Eagles and Bald Eagles. To this end, the USFWS is developing mitigation approaches for maintaining or increasing abundance of Golden Eagles across the landscape. We provide an overview of these approaches, with particular emphasis on programmatic permits for take of eagles that employ multi-party, landscape-scale strategies to effect no-net-loss of the breeding population.





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The Changing Face of Raptor Education

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The days of the diving mules, bicycle riding chimps, dancing elephants and roller skating parrots are a thing of the past. At the fore front of developing future generations of personally responsible young Americans the World Bird Sanctuary encourages them to make decisions that lead to thoughtful earth stewardship and management of natural resources. The World Bird Sanctuary's environment education programs engage in community stewardship by presenting environmental challenges that can be overcome by small individual changes in the home, at school and at work. These educational programs use live birds of prey and other animals to demonstrate human impacts on wild habitats. Our programs are a 45 minute fun and informative presentation that utilize free flying birds of prey, reptiles, mammals and other animals to keep the audience's attention. Collaboration with the Missouri Department of Elementary and Secondary Education has insured that all of our programs conform to the Missouri "Show-Me Standards"- a blue print of the components required by all schools curriculum to build a solid foundation of knowledge, skills, and competencies essential to leading productive fulfilling and successful lives that will benefit and respect our environment and the creatures living in them. Conservation is not a philosophy but a way of life and only through education can we produce this. Education, the key to the future.

Raptors in the Creative Process

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Live raptors are commonly used in educational presentations for schools, public programs, and private groups, illustrating natural history and promoting conservation. They may also be used in artistic endeavors including drawing, painting, sculpting, filmmaking, and photography. These

programs are typically more involved, may last as long as a week, and encourage the artists to understand avian form and function. Instruction involves anatomy with models of a live hawk, and/or falcon and eagle plus owl and discussion of similarities and differences. Children especially delve into color for their final piece. Especially popular are Birds And Art sculpting workshops for kids, in which the students produce life-size papier-mache sculptures of raptors. *Pleine Air* Painting workshops for adults are also held. A week-long camp for young filmmakers concentrates on hands on training with still and video digital cameras, story-building, and computer editing in a television studio. Filming is done at our facility, and the resulting movie is broadcasted, featured in a public screening and entered in the International Wildlife Film Festival. Still photography has been used in publications and in three books, illustrative and adding to the content. We will see examples of art pieces and short films, the results of creative students.

Extended Free Flight: a Different Avian Demonstration Approach

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Environmental education programs using raptors that fly free have been undeniably successful in engaging audiences and enhancing opportunities to educate. Most zoo or museum based shows have followed the successful model developed by Ray Berwick and refined by Steve Martin and others. In 1998, the senior author created an alternative demonstration approach that showcased evolved behaviors rather than behaviors acquired through training. Demonstrations eliminated many anthropomorphic elements common in bird shows, such as music, artificial stage settings, and scripted narration. Natural components of life in the wild were maximized. The prototype program, based at the Arizona-Sonora Desert Museum in



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Arizona, showcased native species along a desert trail in a tract of natural saguaro-palo verde habitat. Perhaps the most important difference was that individual birds were at liberty during demonstrations for extended periods, much longer than the usual fast-paced format of a typical bird show. Birds were able to make decisions about which behaviors to perform and often encountered unpredictable things, such as thermals, inclement weather, wild raptors, and potential prey. Complex behaviors, such as backstanding and supplanting by Harris's Hawks (*Parabuteo unicinctus*), happened naturally and provided interesting and exciting interpretation opportunities. Narrators did not use a script and instead interpreted what birds were doing on a moment by moment basis. Rather than exceeding the attention span of audience members, extended free flight captured visitors with its unscripted authenticity. This kept people focused intently on the birds and open to deeper conservation education. Both authors, working with others, have tested and refined the approach over the past 12 years. Discussion will include training approaches, bird acquisition issues, staff and volunteers requirements, and siting issues for programs of this kind.

Instilling an Appreciation of Raptors without the Use of Captive Birds

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While a (live) bird in the hand is arguably the best way to connect children and adults with raptors, there are other ways to educate the public about raptors and raptor conservation. This session covers techniques for presenting effective programs on raptors without the use of captive raptors. Raptor parts (wings, tails, feet, skulls) and digital images provide an extremely viable alternative. With federal and state salvage permits in possession, road-killed and window-killed raptors have been employed to afford members of the public opportunities to learn more about raptor identification, raptor adaptations and raptor habitat preferences. Public programs involving the use of study skins, mounted birds, raptor

parts and digital images (stills and video) allow people to gain an appreciation for the variety of raptors inhabiting a particular geographic area. These tools enhance identification skills, which is the first step in developing an understanding of and appreciation for raptors, their ecology and their conservation. Use of raptor wings and tails that have been prepared using non-noxious chemicals (borax, dry detergent or table salt) can be handled, which allows close scrutiny and comparison with similar species. At the other end of the spectrum, raptor banding projects, especially those conducted in/near populous areas, provide some wild raptors that can be shown to the public prior to their release. Hawk and owl demonstrations at Cape May, NJ, for example, have been attended by thousands of birders and members of the general public for more than thirty years. Witnessing a wild raptor at close range, then watching it fly away when it is released, makes a lasting impression on members of the audience. Viewing owls, especially secretive Northern Saw-whet Owls (*Aegolius acadicus*), at a banding demonstration may provide a first and only experience many participants will ever have with a wild owl.

This Hawk Can Teach Statistics: Using Migration Monitoring as a Theme for Curriculum Development

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For decades, HawkWatch International has been operating migration monitoring sites throughout the West and Gulf coast regions. All of the sites have a full-season, standardized count of migrating raptors, and some feature trapping and banding activities. In addition to these scientific endeavors, HWI places interpreters at each site, charged with the task of sharing this important work with the public in a responsible way. HWI also offers traditional classroom programs, 30- to 45-min lessons on topics in raptor ecology. For many years, HWI has wanted to bring these experiences together, but the logistics of getting teachers and students into the field have been a



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barrier to participation. This spring, HWI approached the Salt Lake Center for Science Education, a math and science charter school in the Salt Lake School District, with the question: how can you use us? Their answer: you can help us teach high school statistics. In September of 2010, HWI will lead two separate groups of statistics students to the Goshute Mountain Migration Monitoring Station in Nevada, and the students will work alongside crewmembers to understand data collection. They will then learn important statistical functions throughout the school year, using real HWI data in their exercises. In the end of the year, they will analyze data sets to answer their own questions about migration and raptor behavior. The class offers many opportunities to teach about the wonder of raptors, but also explores innovative, thematic teaching methods for math and science.

Creativity and Flexibility in Cage Design for Rehabilitating Raptors

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The Rocky Mountain Raptor Program recently designed and constructed new caging for rehabilitation of injured raptors, and for housing permanently nonreleasable education birds. The key to successful flight caging for rehabilitating raptors are design factors incorporating functionality, flexibility, and safety. Functionality in cage design includes those characteristics such as shape of caging and placement of perches that encourage birds to fly and exercise, or the design may encourage a bird to remain calm with limited exercise while healing. Flexibility in options may include sliding doors, movable perches, and cage configurations that provide choices to birds. Safety for birds is accomplished through the use of proper materials such as wooden slats, and avoiding materials that can cause injury, such as chain link and sharp metal fittings. Double door entries are essential in preventing escapes and some sort of predator protection on the outside of the

caging is also needed. Safety for humans is an important consideration, also, and should be built into the design. Natural history requirements, such as extended care of young in the wild, are important in designing equipment such as hack boxes for hacking fledgling Great Horned Owls (*Bubo virginianus*). Cage design should be approached with a long-term plan that includes anticipated caseload, species, injuries, program budget and staffing, and volunteer resources. Design parameters also should include behavior of individual species, annual cycles, migration, flight and hunting styles.

Raptors' Role in Age-Appropriate Education

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Environmental education often focuses on immense, far-away and abstract problems that seem unsolvable, even for adults but especially for children. Introducing concepts such as endangered species or climate change to children before they are able to process the information often leads to an overwhelming sense of helplessness for those children and results in a disconnect and aversion to the wild world. Many environmental educators propose that before we ask children to take responsibility for the current state of the environment or ask them to champion the protection of the planet or rainforests, we must offer them a chance to discover the mysteries of nature and the chance to connect with and empathize with the wildlife in their own backyards. Cascades Raptor Center, a non-profit nature center and wildlife hospital, uses live, native birds in our education programs to instill the concept of compassion, facilitate a sense of wonder and empathy, and build a connection to the wild world. We are particularly considerate of when to introduce different challenges that wild animals face, depending on the participants ability to respond to the information in a way so they tune in rather than tune out. As our audiences' ability to demonstrate compassion, empathy and



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problem-solving skills increase, we are able to introduce a call to action. CRC's early environmental education programs (age four to six) focus on developing empathy and imagination. Programs for children age six to eight spotlight nature discoveries. While for children age nine-13, CRC programs center around observation and exploration skills. Programs for young adults and adults include a call to action. CRC believes that offering diverse programs allows us to target our messages in a way that encourages our goals of building awareness, stewardship, and appreciation of our natural world. Program examples will be given.

Uses of Falconry Training in Rehabilitating Raptors for Release or Education

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The Avian Reconditioning Center (ARC) is a non-profit raptor facility dedicated to helping raptors through rehabilitation, education and falconry. Located in Apopka, Florida we accept injured and orphaned raptors from the general public as well as from other licensed wildlife rehabilitators throughout the Southeast. We frequently work with Cooper's Hawks (*Accipiter cooperii*), Red-Tailed Hawks (*Buteo jamaicensis*) and Bald Eagles (*Haliaeetus leucocephalus*). Often times the traditional methods of rehabilitating raptors, like the use of surrogate parents for orphaned raptors or reconditioning raptors in large flight enclosures with live prey exposure, are not sufficient for the recovering raptor. In such cases we employ falconry techniques to train and evaluate raptors for their ability to survive after release. Often times we will include hacking for young birds. The use of falconry gives a bird the chance to fly and hunt, if successful the bird will be released. Other falconry techniques incorporated include lure training with a kite or balloon to encourage the raptor to achieve altitude and therefore better conditioning. A down side to falconry is that this is very time consuming. When the end result is that the raptor is

determined to be non-releasable often times the bird has been manned down enough to make a good education ambassador. These birds can be an excellent addition to a raptor program as they allow for the opportunity to educate the public about the importance of birds of prey as well as to recognize indigenous raptors they live with.

Women and Raptors in the 21st Century

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Many of the world's leading raptor experts, past and present, are women who have dedicated their lives to the conservation and welfare of birds of prey. As founder and president of Hoo's Woods Raptor Center, Milton Wisconsin, I will be discussing my personal experiences and challenges as a raptor educator and rehabilitator. I will educate on my experience and research with landfill burned raptors and what is currently being done to correct the problem. As a female falconer in a male dominated sport I will discuss the challenges and current roles of women today in falconry. I serve as director on the board of the North American Falconer's Association (NAFA), the largest falconry organization in the world. We will examine the first female falconer to serve as a NAFA director, Frances Hamerstrom a pioneer in raptor research, and compare to the women currently serving on the NAFA board. My goal in sharing my knowledge and experiences is to inspire other women to follow a career in conservation.

The Cornell Raptor Program – an Approach to Educating Tomorrow's Raptor Educators

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The Cornell Raptor Program (CRP) was established in 1993 with the objective of engaging and training students in raptor biology, natural history, and captive care and management. Program goals are centered on promoting raptor conservation through education, rehabilitation, captive propagation and release of targeted species, and related activities (www.ansci.cornell.edu/raptor). The CRP is administered by a faculty director and student assistant directors. Participants are student volunteers, primarily from the animal and biological sciences, natural resources, and related fields of study. An external advisory board is comprised of experts with relevant program interests. Dedicated facilities house approx. 50 resident birds. Resident birds are acquired as non-releasable rehabilitation cases and from falconers, captive-breeders, and related sources. CRP facilities, activities, and procedures are IACUC, USDA, and AAALAC approved. The educational component of the CRP includes formal classroom instruction, a weekly practicum on raptor care and management, public education training, approx. weekly public education programs, and summer internships. Raptor rehabilitation is carried out in conjunction with the Department of Wildlife Medicine, NYSCVM, and includes post-clinical support and convalescence, treatment and physical therapy, fostering young, evaluation, and release. Captive-propagation and release has been focused on North American accipiters and Red-shouldered Hawks (*Buteo lineatus*) as species of special concern in New York state. Ancillary activities include banding released birds, census by trapping and banding of local raptors, and an on-campus kestrel nest box program. Approximately 2,000 students have participated on a significant level in the CRP since its inception. The majority of these students pursue graduate and professional studies, often related to wildlife conservation and health. Others pursue careers in zoological parks, nature centers, and related establishments where raptor care, exhibition, and education are required. We hope all are equipped to promote the

intrinsic value and conservation of raptors based on their CRP experience.

The International Centre for Birds of Prey, its History, its Future, its Educational Values and its Ethics

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The International Centre for Birds of Prey is the oldest raptor Centre worldwide, and probably the best known, it has gone through four name changes, moved to the US, moved back again, been homeless, got back home again. At no point has it lost the educational drive, the ethics behind the Centre, the huge support it has gained over the years or the reasons for its existence. ICBP has been in existence for 43 years in one form or another, it leads the world in the number of species of raptors bred in captivity, has given one million five hundred thousand flying demonstrations. It is working on such conservation projects as the Vulture crisis in South East Asia and has advised on more topics to do with raptors than most. At all times it has put the welfare, husbandry and interests of captive birds before any other issue and feels very strongly about its education programs. This paper will describe its history, and its future, its educational programs and its ethics towards the birds.

Federal Migratory Bird Educational Use Permit Regulations

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Currently, the U.S. Fish and Wildlife Service (Service) authorizes possession and educational use of migratory birds under a miscellaneous permit category with no codified conditions or criteria governing how birds are acquired, held, or used. The Service is preparing a permit regulation to authorize the possession and use of migratory birds in educational programs and exhibits. The rule also would revise existing



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regulations authorizing possession and public exhibition of eagles. In addition, it would remove the permit exemption for some public institutions for possession of live migratory birds and migratory bird specimens, and clarify that birds held under the exemption must be used for conservation education. For specimens such as feathers, parts, carcasses, nonviable eggs, and nests, the regulations would be updated and clarified to more accurately reflect the types of institutions that may hold specimens for public educational purposes. The regulations would allow exempt institutions to transfer migratory birds to individuals and entities authorized by permit to possess them. Sale and purchase by permittees and exempt institutions would be restricted to properly-marked, captive-bred birds. Upon publication in the Federal Register, there will be a 90-day period in which the public may review the proposed rule and submit comments.

Research Based Conservation Education Using Iconic Species of Wildlife

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Media coverage and educational efforts focused on an iconic species like the Peregrine Falcon (*Falco peregrinus*) can be particularly useful for introducing students and members of the public to the conservation of nature. We report on an outreach program that highlights the accomplishments of conservation biologists at the Santa Cruz Predatory Bird Research Group with a special focus on the Peregrine Falcon population recovery in California. The program has five elements: public presentations delivered by an experienced field biologist who is accompanied by a tame Peregrine Falcon; Peregrine Falcon nest cameras that are accessible to the public at our web site, www.scpbrg.org; a nest camera discussion forum moderated by an experienced biologist; training for those who wish to participate in "fledge watch" at urban nests or monitor nest sites for occupancy and productivity; and, banding nestling

Peregrine Falcons with VID (visual identification) markers to encourage reports of band encounters by members of the public. A growing and increasingly well-organized cadre of public volunteers and university students make possible data gathering to help elucidate the population dynamics of the San Francisco Bay Area Peregrine Falcon Population.

Introducing Sia: The Comanche Nation Ethno-Ornithological Initiative

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Sia is the Numunuh (Comanche) word meaning "feather" but is also the name of the Comanche Nation Ethno-Ornithological Initiative. Sia, also doing business as the Comanche Nation Eagle and Raptor Program, is dedicated to a uniquely Native American ethic regarding the preservation of the eagle and other birds of ethnological significance through cultural understanding of these species in history, science and spirit. Sia was established as an official program of the Comanche Nation in 1999, founded on four decades of ethnological research and raptor preservation and conservation efforts of its co-founders, Troy and William Voelker. The Sia facility maintains a Numunuh (Comanche) material culture museum, an archive of historic unpublished documents, historic photographic archive numbering fourteen hundred images of the Numunuh, library, live eagle facilities designed for tribal and public in house educational programs as well as captive propagation and behavioral research facilities. Sia educational outreach combines authentic, historic life ways and the Comanche perspective in sharing the unique relationship the Numunuh (Comanche) have with many of the avian species of the Southern Great Plains. Sia uses the template developed with Native American cultures and native species in the study of indigenous cultures throughout the world. The specific focus on global species and cultures of shared homelands is predicated on the live birds held in the Sia collection. Eagles and raptors from five



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continents currently reside at Sia. Forensics and DNA analysis is employed for species identification pertaining to historic artifacts. RFID and microchip technology is utilized to provide absolute identification of legally produced feathers prior to distribution of feathers to tribal members. Sia thus combines science, history and indigenous spirit in a unique way by which all can benefit.





Raptors and Zoonotic Infections Special Session Abstracts

Prevalence of West Nile Virus and Saint Louis Encephalitis Virus Antibodies in Argentine Birds of Prey

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Birds of prey are highly susceptible to West Nile virus (WNV, family Flaviviridae, genus *Flavivirus*). The ongoing spread of WNV in Latin America raises concern about the possible effect of this virus in Neotropical birds of prey. More than 116 species of diurnal and nocturnal birds of prey inhabit the Neotropics. The potential impact of WNV infection on naïve populations of threatened or endangered birds of prey in this region may be considerable. The recent detection of WNV in Argentina has raised concern about the potential impact of this virus on endangered naïve raptors populations, such as eagles and other endangered species, present in this country. Therefore, we investigated the prevalence of WNV and Saint Louis encephalitis virus (SLEV) antibodies in blood of 17 species of raptors from Córdoba and Misiones provinces, Argentina. Samples from 41 birds were analyzed by plaque reduction neutralization test (PRNT). From this initial pool of birds, only two individuals of the endangered Argentine Crowned Eagle (*Harpyhaliaetus coronatus*) were found to be seropositive one for each virus. Titers >1:80 suggest recent infection in both birds. Seropositive birds reside in Iguazú, Misiones province, northeastern Argentina (SLEV) and Huerta Grande, Córdoba province, central Argentina (WNV). These results agree with the previously known spatial distribution of these flaviviruses in this country. A high percentage of the investigated birds (97.6%) were apparently never exposed to these viruses. This lack of previous exposure to

WNV and SLEV and protective antibodies suggest that the endangered Crowned Eagle and other threatened species of raptors inhabiting northeastern Argentina may be at high risk if exposed to the deleterious effects of these flaviviruses.

Serological and Parasitological Prevalence of *Toxoplasma gondii* in Colorado Raptors

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Ground feeding birds are considered important in the epidemiology of *Toxoplasma gondii* because they serve as indicators of soil contamination by oocysts and birds of prey are indicators of *T. gondii* prevalence in rodents and other small mammals. Cats excrete environmentally resistant oocysts after consuming tissues of *T. gondii*-infected birds. In the present study, sera and tissues from 459 wild birds from Colorado were tested for *T. gondii* infection. Antibodies to *T. gondii* were found in 46 birds using the modified agglutination test (MAT, 1:25 titer). Tissues (brains, hearts) of 64 birds were bioassayed in mice. Viable *T. gondii* was isolated from 1 of 1 Barn Owl (*Tyto alba*), 1 of 5 American Kestrels (*Falco sparverius*), 1 of 6 Ferruginous Hawks (*Buteo regalis*), and 1 of 4 Rough-legged Hawks (*Buteo lagopus*). This is the first time *T. gondii* has been isolated from the Barn Owl, Ferruginous Hawk, and Rough-legged Hawk.

West Nile Virus and Spotted Owls (*Strix occidentalis*): Threat or Fallacy?

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West Nile virus (WNV) is a mosquito-borne flavivirus that was first introduced in eastern North America in 1999. WNV can cause serious disease in some species of birds with subsequent effects on avian



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populations. By 2003, WNV had spread across North America and first appeared in the range of Spotted Owls, two subspecies of which are listed as threatened. Of concern, there is evidence that owls in general may be particularly susceptible to WNV from both direct transmission by mosquitoes and indirect transmission from infected prey. A variety of evidence suggests that WNV could have severe impacts on Spotted Owl populations. However, current monitoring for WNV in some Spotted Owl populations has failed to detect evidence of WNV infection in Spotted Owls and their prey, infection in other species inhabiting the same areas as Spotted Owls, and the principal mosquito vectors responsible for WNV transmission. In contrast, WNV has been detected within the range of Spotted Owls through County and State surveillance efforts. Here, we present why WNV should be of concern in conservation and management of Spotted Owl populations, possible explanations of why it has not been detected in Spotted Owl populations, and some simulation scenarios of how it could affect Spotted Owl populations, which have applications to raptor populations in general.

Occurrence of West Nile Virus Infection in Raptors at the Salton Sea, California

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We investigated the prevalence of West Nile virus (WNV)-neutralizing antibodies and infectious virus, and the occurrence of overwinter transmission in two raptor species during January and March 2006 at the Salton Sea, Imperial County, California. We captured 208 American Kestrels (*Falco sparverius*) (January, $n = 100$; March, $n = 108$) and 116 Burrowing Owls (*Athene cunicularia*) (January, $n = 52$; March, $n = 64$). Laboratory analysis revealed that 83% of American Kestrels and 31% of Burrowing Owls were positive for WNV-neutralizing antibodies. Additionally, two seroconversions were detected in Burrowing Owls between January and

March. Infectious WNV, consistent with acute infection, was not detected in any bird.

Avian Influenza Viruses in Raptors

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While waterfowl (primarily Anseriformes and Charadriiformes) are the traditional reservoirs of avian influenza viruses (AIV), the continually evolving nature of these viruses allows for infection of many different species. Low pathogenicity (LP) and high pathogenicity (HP) AIV have historically caused subclinical infections in wild birds, although the relatively recent emergence of HP AIV H5N1 Asian strain has led to morbidity and mortality among many avian species, as well as mammals. The primary transmission mechanism of AIV among birds is fecal-oral, and influenza viruses remain infectious in water for relatively long periods. Therefore, many birds become infected via ingestion of viruses in water or respiratory exposure of aerosolized AIV. Raptors are at additional risk of HP AIV infection via consumption of infectious prey. Reports of raptor AIV infections include falcons in the Middle East and smuggled eagles from Thailand confiscated in Belgium. In addition, falcons in Saudi Arabia died of HP AIV H5N1 after contact with infected bustards, and HP AIV H5N1-experimentally infected American Kestrels (*Falco sparverius*) succumbed to infection. HP AIV H5N1 infection in raptors and other birds has led to severe systemic disease, sometimes with neurologic manifestations. Recently, raptors have been included in AIV surveillance, leading to lack of detections among live and dead raptors sampled in Spain, Sweden and the United States. However, sampling of carcasses of numerous raptors, including hawks, eagle owls and a falcon, produced successful detections of HP AIV H5N1 in Sweden and Denmark. Thus far, HP AIV H5N1 has spread throughout parts of Asia, Europe, the Middle East and Africa, and the effects of HP AIV H5N1 are potentially devastating on many avian species, including raptors. Therefore, a better



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understanding of the effects of AIV in raptors, and specifically HP AIV H5N1, can be achieved by the inclusion of raptors in global surveillance efforts.

West Nile Virus in Raptors

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Since 1999, West Nile virus (WNV) has rapidly spread across much of North America, leading to fatal infections among countless birds. Raptors have been no exception to these detrimental effects, which have resulted in a variety of disease syndromes (from subclinical to fatal infections) among species within five families. While it is difficult to track and understand the ongoing effects of WNV on raptor populations, the effects of WNV have been studied in a variety of free-ranging and captive raptors. Experimental data have demonstrated that numerous raptor species are competent reservoir hosts, in that they reach viremia titers sufficient to infect mosquitoes and support transmission cycles. In addition to the traditional WNV transmission route of mosquito-inoculation, raptors are also susceptible to WNV infection via ingestion of infectious prey. However, the latter route appears to be a much less efficient means of transmission. Clinical syndromes and outcomes vary among species; for example, Great Horned Owls (*Bubo virginianus*) appear more likely to suffer from neurologic disease, while American Kestrels (*Falco sparverius*) and Swainson's Hawks (*Buteo swainsonii*) are more likely to have non-specific signs such as emaciation, dehydration, and abnormal feather growth. Species of concern include the Ferruginous Hawk (*B. regalis*), Golden Eagle (*Aquila chrysaetos*), and numerous northern owl species. Raptors that succumb to infection suffer from apparently uncontrolled virus replication within all tissues, and inflammation and necrosis are often present within multiple tissues. However, in a rehabilitation setting, a relatively high rate of release (i.e., approximately 60%) has been achieved

among WNV-infected raptors, including individuals with neurologic syndromes. Aside from WNV infection resulting in clinical disease, it is known that many free-ranging raptors survive infection, as healthy seropositive individuals have been documented throughout the United States. In addition, raptors have played an important role in monitoring WNV activity throughout the United States.





Poster Session Abstracts

Habitat Use and Breeding Success of Peregrine Falcons (*Falco peregrinus*) in Lake Mead National Recreation Area

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Portions of Lake Mead National Recreation Area (LMNRA), within the arid eastern Mojave Desert on the border of Nevada and Arizona, have Peregrine Falcon territory densities rivaling some of the highest documented for this species. From 2006-2009, we documented 35 territories within the 3,765 km² recreation area, with nearest neighbor distances between occupied eyries as little as 1.21 km (mean 3.25 km, $n = 17$) within canyon areas bordering two large reservoirs. While the local breeding population has undergone growth in recent decades, the rate and timing of the expansion is difficult to determine because of variation in survey efforts over time. However, the breeding density in a single 35 km stretch of river channel, surveyed thoroughly in the early 1990s (1 pair/8.75 river km), has nearly doubled by 2009 (1 pair/4.5 river km). In 2008 and 2009, breeding success at territories near the shoreline (≤ 750 m, $n = 39$) was 82% with 2.2 young/attempt and 2.7 young/successful attempt, in contrast to 33% breeding success, 0.5 young/attempt and 1.5 young/successful attempt in territories farther from water (> 750 m, $n = 12$). We speculate, however, that some of this difference may relate to the increasing density of Peregrines in the region with younger birds establishing territories farther from the shoreline cliffs at presumably lower quality territories. Territory quality and breeding success at near-shore territories are likely positively impacted by the large numbers of wintering and migrating aquatic and riparian birds using the area. These bird species accounted for at least 68% of all observed prey attempts ($n = 204$) and for 45% of collected or observed prey remains ($n = 174$) at eyries and plucking

perches. Clearly, the number of breeding Peregrines at LMNRA has increased substantially since the first breeding pair was discovered in 1985 and now represents an important regional breeding area.

Phylogeography and population history of Northern Goshawks across North America

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We examined the genetic relationships among 21 populations of Northern Goshawks (*Accipiter gentilis*) from across a large portion of their Nearctic range. We used mitochondrial control region sequences from 315 goshawks to address questions concerning historical isolation within Pleistocene refugia, demographic history and post-glacial gene flow. Results indicated goshawks were genetically variable across their range and exhibit significant genetic structure at broad geographic scales. The geographic distribution of haplotypes indicate that goshawks were historically isolated into at least three glacial period refugia (Pacific Coastal, Southwestern and Eastern) and have subsequently experienced limited post-glacial range expansion from these regions. Dating of range expansions indicate goshawks in the East and Rocky Mountains experienced demographic growth ~ 10 000 YA (years ago), while demographic growth in goshawks on the Colorado Plateau-Southwest occurred ~ 17 000 YA. Goshawks in California experienced a historical bottleneck that resulted in the population having substantially less genetic diversity as compared to most other populations. Similar results were seen for goshawks in the Arizona Sky Islands, which were nearly fixed for a single region-specific haplotype, and for goshawks in the Jemez Mountains of New Mexico. Overall, we



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identified six major regional populations based on genetic differences: Southeast Alaska, California, Colorado Plateau, Arizona Sky Islands, New Mexico and a large group including the Rocky Mountains, Great Lakes and Central Appalachian Mountains. We hypothesized that rapid post-glacial gene flow of a single haplotype from eastern populations into the Rocky Mountains has partially homogenized the genetic structure among these geographically distant populations; however each of the Rocky Mountains, Great Lakes and Central Appalachian populations had their own region specific haplotypes.

Movements of Adult Male Cooper's Hawks (*Accipiter cooperii*) During the Breeding and Non-Breeding Season in an Urban Environment

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Variation in home range size between the breeding and non-breeding season for raptor species is influenced by a multitude of factors, including availability of food, cover, and water, intra- and inter-specific competition, and behaviors associated with maintaining pair bonds. Information about home ranges throughout an annual cycle potentially improves understanding of the conditions required for raptors to persist in novel environments, such as urban areas. We radio-tagged 13 adult, male Cooper's Hawks in Tucson, Arizona and monitored their movements through an annual cycle. We identified their breeding season and non-breeding season home ranges to assess how home ranges change throughout the year. The average (\pm SE) percent change in home range size between the breeding and non-breeding season was an increase of 205.8% (\pm 138.6%). Size of home ranges among hawks varied during both the breeding and non-breeding season (10.4–76.1 ha and 19.6–220.0 ha, respectively) and averaged 36.6 ha \pm 7.08 during the breeding season and 71.6 ha \pm 17.5 during the non-breeding season.

Of the 13 radio-tagged hawks, 10 hawks had larger home ranges during the non-breeding season than during the breeding season. For one male, the breeding season home range was larger than the non-breeding season home range (76.1 ha, and 19.6 ha respectively). The size of home range of another hawk did not change throughout the year (56.7 ha). We speculate that home ranges are smaller during the breeding season because males stay close to females to guard them from other males and the need to return to the nest frequently restricts hunting activities to areas relatively close to the nest. We also speculate that in Tucson Cooper's Hawks have smaller home ranges compared to more natural environments because of the high abundance of prey throughout the year.

Utility of Helicopters for Short-eared Owl (*Asio flammeus*) Nest Searches and Surveys

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Based on the North American Breeding Bird Survey (BBS), Short-eared Owl populations have undergone long-term, continent-wide, annual declines. However, BBS data from Alaska are insufficient to detect a population trend, probably because there are few roads on which BBS surveys are conducted. Roadless areas in Alaska and elsewhere also pose significant challenges to demographic and other focused research projects because finding owl nests in such areas with ground-based methods can be prohibitively difficult. Therefore, we evaluated using a helicopter to conduct Short-eared Owl surveys and nest searches by flying transects 5-15 m above the ground in Interior Alaska. We flew 416 km of transects and observed 45 Short-eared Owls. Of these, 17 owls were first detected while flying or perched above the ground and 28 flushed from the ground (average one flush per 15 km). We found two



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Short-eared Owl nests containing eggs, one during a ground search and the other from the air after a flush. Owls flushed an average of 65 m in front of the helicopter (range 30-150 m); no owls were detected flushing to the sides or rear of the helicopter. We re-surveyed 13 (46%) owl-flush locations on the following day and found owls at six of these locations, including both nests. Our results demonstrated that low-flying helicopters can be used to count Short-eared Owls and successfully search for their nests in remote areas, though more research into detection probability and potential effects of disturbance on nesting birds is needed.

Multiple Uses of Roosts Sites in King Vulture (*Sarcoramphus papa*)

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The use of communal roosting sites is a typical characteristic of vultures yet the importance of these roost sites remain little studied in the King Vulture. Past studies have shown that King Vulture roost site selection requirements include: large mature trees such as Black Olive (*B. buceras*) and Chicle Tree (*Manilkara zapota*); large tracts of mature forests; and close proximity to a body of water. With increased habitat encroachment by human settlements and an increase in roost abandonment, there is concern that adequate roosting sites are quickly disappearing and how this may impact the local King Vulture population is unknown. In this study we report the activities of King Vulture's at roosts sites in the Southern Yucatan, Quintana Roo, Mexico. Between September and December 2009, we spent over 200 hr observing two roosts from nearby blinds high in tree canopy for a total of 25 h of noted behaviors. Preliminary results of focal sampling show that in one of the roosts King Vultures spend

most of their time resting (i.e., perching, sleeping; 76.1%) and preening (18.8%). At the other roost, King Vultures were observed sunbathing with open wings 52.1% and resting 29.4% of the time. In addition to these results we found that bathing and drinking was not observed frequently but regularly and appears to be an important function of these communal roost sites. This study will be continued in 2011, will include a third roost site, and will focus on social interactions at roost sites.

Documentation of a Four-chick Bald Eagle Brood Fledged Along the Delaware River, Northampton County, Pennsylvania

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Brood size is a life history trait that reflects a broad range of evolutionary tradeoffs. In many raptor species, maximum brood size responds to energetic constraints on both clutch production and brood provisioning. For Bald Eagles (*Haliaeetus leucocephalus*), brood size typically varies between one and three and geographic patterns in both average brood size and proportion of three-chick broods are believed to vary with prey abundance. Bald Eagle broods hatch asynchronously, often form dominance hierarchies, and may exhibit brood reduction depending on prey availability. Under normal circumstances, the degree of hatching asynchrony for unusually large clutches likely creates such a disadvantage for the last chick that it sets an upper bound on brood size. However, high female condition may reduce laying time and favorable temperatures may allow for the delayed onset of incubation, effectively reducing hatching asynchrony. Similarly, under very high prey conditions, provisioning rates may prevent the formation of dominance hierarchies and reduce the likelihood of brood reduction. Although four and five-egg clutches have been reported with some



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regularity in Bald Eagles, the successful fledging of a four-chick brood is extraordinarily rare. Here we document a breeding attempt that successfully fledged a four-chick brood along the Delaware River. We made observations of the nest during 55 days between 10 April and 24 July, 2009. Provisioning rates frequently exceeded 1 prey item/hr and sibling aggression was not observed. All four chicks fledged during 4 days from 19 to 23 June.

Ospreys and PBDEs from Columbia River Basin, USA, 2002-2009

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Polybrominated diphenyl ethers (PBDEs) are bromine-based compounds used as flame retardants in thermoplastics, textiles, polyurethane foams and electronic circuitry since the 1970s. PBDEs persist in the environment and bioaccumulate and biomagnify up the food web to the top predatory fish, mammal and bird species. In contrast to DDE and other banned pesticides and polychlorinated biphenyls which decreased in recent years in Osprey (*Pandion haliaetus*) eggs from the Columbia River Basin, PBDEs increased in Osprey eggs from Oregon, Washington and elsewhere. This study was designed to:

(1) determine PBDE and total hexabromocyclododecane concentrations in fish-eating Osprey eggs (one egg collected at random per nest) at locations with the Columbia River Basin in Oregon, Washington and Idaho in 2008 and 2009 and to compare concentrations and congener profiles among locations, (2) evaluate temporal trends in PBDE concentrations with Osprey eggs collected during earlier investigations at two locations (Upper Willamette River 2006 vs. 2008, and Lower Columbia River 2004 vs. 2007 vs. 2008 vs. 2009), (3) evaluate reproductive

success (number of young produced) at each nest with a sample egg collected to determine if an association exists with PBDE concentrations in the egg from that nest, (4) evaluate PBDE residue concentrations in fish and Osprey eggs from the specific study areas to estimate congener-specific biomagnification factors from fish to Osprey eggs, and (5) evaluate general PBDE residue patterns in Osprey eggs from the Columbia River Basin and possible relationships between river flows (cfs), and human population size (or volume of wastewater treatment discharge) at eight sites where eggs were collected between 2002 and 2009 (Boise River, Spokane River, Yakima River, Lower Columbia River, Upper Willamette River, Lower Willamette River and two Reference Sites (Headwater Reservoirs on Willamette River and several lakes in vicinity of Spokane River).

Status of Peregrine Falcon (*Falco peregrinus*) in Canada

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Peregrine Falcons populations across southern Canada were decimated by DDT prior to 1970. The release of captive bred peregrines in the 1980s and 1990s returned the falcon as a nesting species south of the treeline. Since 1970, surveys every five years across Canada have tracked the recovery of this species. Despite the continued recovery in most areas of Canada, the prairie, Labrador and Yukon populations have not continued to grow. Few pairs of falcons nest on natural sites in the prairies; those remaining are clustered in urban areas. This poster will present the results of the 2010 national survey and discuss the results in the context of regional reintroductions and recovery.



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Winter Destinations and Ecology of "Canadian Burrowing Owls" (*Athene cunicularia*)

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The winter destination and ecology of Burrowing Owls (*Athene cunicularia*) that breed in Canada was unknown when this study was initiated. We identified the winter locations of owls using aerial telemetry searches of south Texas and the Gulf Coast lowlands and central Mexico for signals from VHF transmitters that were attached to Burrowing Owls in Canada; using stable isotope analysis; using light data loggers and in 2010 using PTT satellite transmitters. We have combined these records with all band recoveries to provide an up to date picture of what is known about winter distribution of 'Canadian' Burrowing Owls. We studied the over-winter survival, diet and habitat of the owls in one study area in south Texas, and two in central Mexico. The winter day time roosts used by the owls included vegetation, natural burrows, arroyos and wood piles. Winter habitats around roosts were also highly variable, much less open than breeding habitat in Canada but always included at least 35% low vegetation within 1 km of roosts. In the winter predators included barn owls and short-eared owls. Another owl died due to earth moving equipment. Over-winter mortality was estimated at 17-30%. Survival in winter cannot explain why only 6% of juvenile owls return to Canadian study areas. The return rate of owls with attached data loggers was very low but the one recovered indicated that Alberta nesting owls may migrate further west than owls from Saskatchewan and Manitoba.

Home Range of Female Peregrine Falcons (*Falco peregrinus anatum*) during the Breeding Season in Southern Québec, Canada

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In North America and Europe, negative impacts of wind farms on birds of prey have been well-documented. In Eastern Canada, the province of Québec is currently promoting the development of its potential for wind energy generation, which should reach 4000 MW by 2015. Peregrine Falcons are particularly sensitive to the presence of wind turbines, because the species is susceptible to flying at a propitious altitude for blade-strike mortality. In order to evaluate the risk of the expansion of wind power plans on this species in Québec, it is essential to characterize its habitat use during the breeding season. The main objective of our study is therefore to determine habitat types affecting home range size. Eight female Peregrine Falcons were tracked with satellite transmitters in 2008 and 2009, throughout incubation, rearing and postfledging periods. We used 95% minimum convex polygon (MCP) to estimate boundaries and size of each home range. Estimated size, varying from 2 to 2338 km², probably reflects the heterogeneity of habitats between home ranges. According to model-selection approach (AICc), the breeding period (incubation, rearing of young, postfledging) and the proportion of agricultural lands within the home range were the most important variables explaining home range size. Home range of individuals tracked by telemetry increased from incubation to postfledging period. Contrary to our expectations, an increase in the proportion of agricultural lands within the home range was related to an increase in its size. These results, combined with analyses of resource selection functions at home range scale will be used to assess the vulnerability of



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Peregrine Falcons to wind farm developments.

Identifying Individual Northern Goshawks (*Accipiter gentilis*) Using Patterns on Molted Feathers

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Previous studies of accipiters have used molted feathers as a means of identifying individual birds, but in general, the accuracy of these identifications have not been quantified. Northern Goshawks have been studied on the North Kaibab Plateau from 1991-2010 and feathers were collected in individual territories during the breeding seasons. In association with this larger project, we have initiated a study to examine the efficacy of identifying individual Northern Goshawks using molted feathers from active territories and comparing identifications to mark-recapture identifications made during the same period of time. We review previous research using molted feathers, discuss challenges in using feathers for identification, and present our methodology to evaluate feather-based identifications. We further present feather characteristics identified in preliminary studies and characteristics we are examining using ImageJ software.

The 2006 Kaibab Plateau Warm Fire: Effects of Fire Severity on the Northern Goshawk (*Accipiter gentilis*)

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The 2006 Warm Fire burned 58,280 acres of Ponderosa Pine and Mixed Conifer forest on Arizona's Kaibab Plateau during June-July 2006. Thirteen Northern Goshawk territories were burned at high severity and 5 at low severity. Bird and mammal (goshawk prey) counts and vegetation changes post-fire (2007-2009) are being compared to pre-fire prey census and vegetation measures conducted in 1999-2004 to document changes in goshawk habitat. Prey census from 1999-2004 showed a strong relationship between goshawk breeding and abundance of prey. Prey census in high severity fire sites showed a reduction in detections of several important prey species over unburned sites. The effect of low and moderate severity fire on vegetation composition and structure and prey abundance are currently being investigated.

Investigations of the Breeding Ecology of the Northern Hawk Owl (*Surnia ulula*) In Western Montana

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In North America, the Northern Hawk owl primarily breeds in the boreal regions of Alaska and Canada. It also irrupts southward into contiguous lower 48 United States, occasionally breeding in states of northern latitude. In the Lower 48, Northern hawk owl nests primarily occur in Montana and Minnesota. Within Montana, breeding centers on Glacier National Park. In 2006, the Owl Research Institute began a study of the breeding ecology of Northern hawk owls in Glacier National Park. This is the first systematic study of the species in the continental U.S. Since 2006, twelve Northern hawk owl nests have been discovered, augmenting the number of documented Montana nests from 4 to 17.



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The project has also banded 50 young and adult Northern hawk owls. In this program, survey methods, baseline breeding ecology, and habitat associations are described. Also discussed is the status of the Northern hawk owl, which is experiencing habitat decline due to forest management practices across the continent.

Seasonal variation of raptors at oases of Baja California Sur, México

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Oases are isolated permanent or semipermanent bodies of spring-fed water and with vegetation along their edge with the arid desert of the southern Baja California peninsula. The high annual mean temperature and low precipitation characteristic of the desert in BCS contrast with the milder conditions inside the oasis and with the water available. Approximately 80 typical oases have been located in the state of Baja California Sur through aerial photography and satellite imagery. Only five oases show a water surface greater than 1 km², with the majority of them between 10 and 600 m². The oases of Baja California are considered relictual habitats that serve as a refuge for many mesic species and that are attractive patches for fauna as they support disproportionately large numbers of wildlife. They contain a number of endemic species of both invertebrates and vertebrates and function as stopovers during bird migration. In this study we present the seasonal variation of raptors in five oases of Baja California Sur. We present their occurrence and abundance and we determined the most important oases for raptor populations during the migration time. We found 15 diurnal raptor and 3 owl species using the oases during the year. Differences in species richness between oases are noted. We suggest that the number of raptors may depend on the size of the oasis but that is also related to the route migrant populations follow through the

peninsula (e.g. the oasis is within the migration route). Discussion on the use of oases by "rare" species is presented.

The Effects of Severe Drought and Large Wildfire Incidents on the Golden Eagle Population in the Goshute Mountains of Northeastern Nevada

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The Golden Eagle (*Aquila chrysaetos*) breeds in scrubland, grassland, farmland, tundra, and open forests; thus higher populations of Golden Eagles reside in the Western States. During breeding or stop-over within the Intermountain region, Golden Eagles rely on black-tailed jackrabbit (*Lepus californicus*) as preferred prey, thus, population success can be tied to jackrabbit abundance. The Goshute Mountain count site in northern Nevada has exhibited a significant decline in Golden Eagles that began in 2001. This decline appears to be correlated with a severe drought that began in 1999. In addition, 1998 marked the ending of an El Niño period and the beginning of several large wildfires. We explored existing data sets for any relationship between drought and wildfire with declining numbers of Golden Eagles in the Goshute Mountains, utilizing data from the Raptor Population Index (RPI), the Palmer Drought Severity Index (PDSI) and wildfire records for Elko County, Nevada. The results showed a lower annual mean count of Golden Eagles during the post-El Niño years but this was not statistically significant. The regression analysis using no lag showed a slightly significant relationship between increasing drought severity and declining annual eagle count. As a drought progresses, the effects of the drought on the eagles' prey base (jackrabbits) would not have been immediate; the decline in prey base might take a few breeding seasons before their population showed a decline. Using a three-year lag between onset of drought and Golden Eagle numbers, the regression analysis showed a significant relationship



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between increasing drought severity and declining annual Golden Eagle counts. In addition, the study revealed a cause-effect relationship between large wildfires and declining eagle numbers.

The Nesting Ecology of White-tailed Hawks (*Buteo albicaudatus*), Red-tailed Hawks (*Buteo jamaicensis*), and Crested Caracaras (*Caracara cheriway*) in South Texas

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We investigated the nesting ecology of three sympatric raptors on a large private ranch in Brooks County, Texas. White-tailed Hawks and Crested Caracaras are some of the least studied raptors in North America, and the ecology of Red-tailed Hawks in Texas has not been thoroughly studied. In order to examine potential factors that may affect the populations at various years, we compared reproductive estimates over a seven year period (2003-2009) and compared productivity between wet and dry years. The observed nest success of White-tailed Hawks differed between wet and dry years ($n = 173$, $P = 0.002$), whereas similar nest success was evident for Crested Caracaras and Red-tailed Hawks. Mayfield nest success estimates were substantially lower for all three species during 2005 and 2006. The number of White-tailed Hawk nestlings differed between 2005 and 2007 ($n = 178$, $P = 0.04$). The number of fledglings differed between all wet and dry years ($n = 178$, $P < 0.0001$). Among Red-tailed Hawks and Crested Caracaras, no significant differences were apparent between wet and dry years in terms of the number of nestlings and fledglings produced. Laying dates during 2005 and 2006 versus 2004 and 2007 differed for White-tailed Hawks

($P = 0.01$), while Red-tailed Hawks differed between all wet and dry years ($n = 60$, $P < 0.0001$). Laying dates of Crested Caracaras were similar between all wet and dry years. Nest predation events of White-tailed Hawk nests were similar between the egg and nestling stages, while Red-tailed Hawks nests were mostly depredated during the nestling period. The average population density of territorial White-tailed hawks ranged 0.03-0.11 pairs/km², 0.007-0.11 pairs/km² for Red-tailed Hawks, and 0.02-0.11 pairs/km² for Crested Caracaras. The results showed that the wet and dry cycles that occurred during the seven years influenced the productivity of White-tailed Hawks, while having a lesser impact on Red-tailed Hawks and Crested Caracaras.

Diet of Adult Cooper's Hawks (*Accipiter cooperii*) in North Florida, and Calculated Rates of Predation on Northern Bobwhite (*Colinus virginianus*)

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We studied the diet and foraging ecology of 22 adult male and 31 adult female radio-tagged Cooper's Hawks on two north Florida study areas throughout the year from 1995 until 2001. One study area was a Northern Bobwhite (bobwhite) hunting plantation and the second was a mixture of farmland and woodlots not managed specifically for bobwhite. We recorded 1,100 breeding season (March through July) and 193 non-breeding season (August through February) Cooper's hawk prey captures in 2,500 hr of systematic radio-tracking. Cooper's hawks captured 76 species of birds, mammals, and reptiles, but birds comprised 88% of the breeding season and 98% of the non-breeding season prey captures by frequency. Mourning doves (*Zenaidia macroura*), blue jays (*Cyanocitta cristata*), bobwhite, cattle egrets (*Bubulcus ibis*), and northern mockingbirds (*Mimus polyglottos*) each made up over 4% of prey captures by



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frequency. At ten nests where we monitored prey deliveries using digital video cameras, nestling birds comprised 59% of prey brought by adult male Cooper's hawks to nests. Most females did no foraging during the breeding season; overall, females accounted for only 15% of all prey brought to nestlings. When they did forage, female Cooper's hawks took heavier prey on average than males throughout the year. We estimated that bobwhite comprised 3% of adult male and 5% of adult female Cooper's hawks prey captures by frequency. The rate of predation on bobwhite by adult male Cooper's Hawks was evenly distributed throughout the year, but female Cooper's hawks captured bobwhite mainly in winter. We estimate that on average, each adult male Cooper's hawk in our study captured 19 and each adult female captured 15 bobwhite per year.

When Peregrines Fight: Territorial Advertisement and Defense Behavior

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Peregrine Falcons (*Falco peregrinus*) on breeding territories have a graded series of advertisement and defense behaviour patterns. Advertisements warn off all but the most persistent intruders. Defense usually is sex-specific. A persistent intruder causes threats, chase, aerial attack/defense activities, and sometimes grappling and ground fighting. Aerial fighting is extremely dangerous; ground fighting is even more so. Disengagement from ground fighting is difficult; one or both combatants may be injured, sometimes fatally. Well observed (including with webcams) fights at urban eyries in the U.S. Midwest from the 1980s onward were suggested to have arisen from the variety of genetic (migratory and resident) backgrounds of the original released falcons; other evidence suggests other reasons for those fights. (1) Studies at Rankin Inlet, Inuvut, Canada, from the 1980s to the present showed that tundra

migrants regularly fight for territories upon arrival in spring. (2) Urban Peregrines at Edmonton, Alberta, Canada, provided unprecedented opportunities to observe fights when late-arriving breeders carrying satellite telemetry encountered opponents which had been on the territories for 2-3 wk. (3) A mostly-resident, marine breeding population at Langara Island, British Columbia, Canada, had fights at various times in the year, including at the spring arrival of the few migrants, and at mid-incubation followed by a clutch laid by the new owner when most others' nestlings were at banding age. Occasional heavy winter mortality of resident breeders appears to select for the mixed strategy of some residents and some migrants. Similarly, occasional lethal spring weather may select for a mixed migratory strategy with some early- and some late-arrivers despite the serious fights that may arise. Forty years ago Peregrine fights were thought to be extremely rare events; however, because of saturated or near-saturated breeding populations, and many observers, webcams, and satellite telemetry, today we think Peregrine fights are regular events.

Home Range Composition and its Effects on Reproductive Success of Breeding Snail Kites (*Rostrhamus sociabilis plumbeus*) on the Kissimmee Chain of Lakes in Florida

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The Snail Kite is a federally endangered raptor whose population in Florida has recently undergone precipitous declines. The remaining population remains heavily dependent upon the Kissimmee Chain of Lakes (KCOL), a group of lakes in central-Florida that is subject to many anthropogenic influences, including water and vegetation management. It is therefore crucial to gain an understanding of how the habitat on these lakes influences kite reproduction. We studied the role that habitat on the KCOL plays in reproductive



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success by radio-tagging and observing adult breeding Snail Kites by airboat. We delineated home ranges using a kernel density estimator, and identified vegetative patches within the ranges via aerial imagery and ground-sampling. We additionally quantified foraging effectiveness through time activity budgets and tracked the survival of fledglings through radio-telemetry. We then compared the vegetative composition of the home-range and parent foraging efficiency with nest success and, subsequently, fledgling survival. Our preliminary results indicate a relationship between home range size, and thus distance to foraging areas from the nest, and nest success. Additionally, several specific vegetation types appear to be correlated with nest success and home ranges with a lower diversity of vegetation types tended to produce more successful nests. This information will be useful in guiding management on the KCOL in directions that will be non-detrimental and potentially beneficial to Snail Kite breeding, and thus the recovery of the population.

Guidelines for Owl Surveys in North America, an Update to the Nocturnal Guidelines Booklet

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The Guidelines for Nocturnal Owl Monitoring in North America published by Beaverhill Bird Observatory and Bird Studies Canada in 2001 (authors L. Takats, C.M. Francis, G.L. Holroyd, J.R. Duncan, K.M. Mazur, R.J. Cannings, W. Harris, and D. Holt. Website: <http://www.bsc-eoc.org/download/owlguidelines.pdf>) has been used extensively for owl researchers setting up monitoring programs in North America and Europe. A successful volunteer owl survey program has been running since 2002 in Canada. Surveys are coordinated provincially and standardized data is submitted to Bird Studies Canada. In Alberta for example, over 200 volunteers survey for nocturnal owls on almost 100 routes. The Owl Working Group from the previous

guidelines work and new owl survey coordinators plan to update the booklet, by including diurnal owl survey methods and including information on timing of surveys for the various owl species in North America. We present information on the Guidelines, results from some of the surveys being conducted in Canada, and information on the new guide and how to get involved in the project.

The Complex Relationship between Northern Goshawks (*Accipiter gentilis*) and Their Habitats on the Kaibab Plateau, Arizona

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The basis of habitat quality as a concept for a species lies in the demography of that species. Our objective of using the relationships between the composition and structure of forest vegetation and 20-year estimates of Northern Goshawk vital rates, mate and territory fidelity, and the direction and consequences of breeding dispersal on the Kaibab Plateau is showing that inferring habitat quality based on demographic performance of individuals is not straight forward. The relationship is confounded by large, weather-driven, inter-annual variation in prey abundance, variable recruitment of breeders on territories, multidirectional (as opposed to unidirectional) breeding dispersals, and large differences in breeding life spans resulting in large differences in total reproduction of individuals -- all of which are independent of the composition and structure of forest vegetation at the territory and home range scales.



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Evaluation of the Northern Goshawk as a Biodiversity Conservation Tool

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Habitat loss and fragmentation are the primary threats to biological diversity. Hence, it is imperative that we develop sustainable land-use strategies for biodiversity conservation. Maintaining a landscape configuration that promotes viable populations of multiple species requires identifying critical habitat conditions over a range of spatial scales. Perhaps the most effective way to handle the complexity of biological systems is through the use of surrogate species associated with the natural structure and species composition of targeted ecosystems. The Northern Goshawk (*Accipiter gentilis*) may be an appropriate surrogate for biodiversity in forest ecosystems because: (1) they are widely distributed throughout the Holarctic and require large areas that incorporate numerous habitats of smaller, less area-demanding species; (2) they are often associated with a narrow range of vegetation characteristics; (3) they are sensitive to disturbances that alter elements of forest structure associated with greater species diversity; (4) as a generalist predator in a complex food web, they exploit numerous bird and mammal species; (5) their life history characteristics facilitate the assessment of local environmental conditions; and (6) breeding adults are relatively easy to monitor and their reproductive rates respond to variation in habitat quality at spatial scales relevant to biodiversity conservation. Forest elements such as stand structural complexity, plant species composition, heterogeneity, and size and arrangement of plant aggregations are positively associated with goshawk reproductive rates and abundant populations of diverse prey species. However, studies are needed to clarify the relationships

between goshawk habitat and components of biodiversity. Goshawk habitat can be an appropriate management target without being a panacea for all species residing within forest ecosystems because the research involved in exploring the efficacy of goshawks as a biodiversity surrogate will inevitably improve our understanding of these systems and our ability to manage them.

Productivity and Nest Site Selection of Urban Mississippi Kites (*Ictinia mississippiensis*)

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We studied nest success, productivity, and site occupancy of Mississippi kites in urban green spaces in Lubbock, Texas from 2006-2009. In 2009, we began studying habitat selection with urban green spaces. For 198 nests, Mayfield nest success averaged 78% across all years and productivity averaged 0.90 young per nesting attempt. Nest success and productivity did not vary among years. Among breeding areas used in two or more years, kites reoccupied nest 62% of the time. In 2009 elm (*Ulmus* spp.; 62%) and locust (*Gleditsia* spp.; 19%) were most frequently used for nesting, but were not used more than would be expected based on availability ($P = 0.07$). Trees selected for nesting were taller and had greater girth than randomly selected trees. Mean nest height was $11.13 \pm \text{SD } 2.99$ m. Nest trees were not significantly further from roads or buildings than random trees. Within nesting areas (30 m radius center on nest tree), mean tree height, basal area, and canopy cover at 0 m from the nest tree was greater for nest sites than for random trees. The amount of paved surfaces (roads, parking lots, etc.) within the nesting area did not differ between used sites and available sites. Our results suggest that though kites



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are tolerant of anthropogenic structures and surfaces in the vicinity of nests, groves of mature trees are essential for maintaining kite populations in urban areas.

Plumage, Polygyny, and Polyandry: an Unusual Nesting by an American Kestrel Female, Santa Fe, New Mexico, USA

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On 24 April 2009 a female American Kestrel (*Falco sparverius*) with unusual plumage was first observed near a nest box in Santa Fe County, New Mexico (35° N). When captured on 27 June 2009 this female was found to have an approximately 50:50 mix of brown female and off-grey wing coverts; her folded wing gave a visual impression of a faded, partially male plumage. Behavioral observations over 26 hr between 24 April and 28 July provided evidence of the first documented case of a polygynous mating by an American Kestrel male in North America. This male was the primary, and perhaps only, male to copulate with the lone, grey-winged female at the nest box 280 m from the nest box occupied by his first mate. His visits to the second nest box were first noted after incubation began in the primary nest box, but may have occurred earlier. Copulation with the grey-winged (second) female was observed 17 times before she initiated incubation (9.5 observation hr), six times during incubation (7 observation hr), and once after the hatching of the second brood (9.5 observation hr). While he apparently provisioned prey for his primary mate at a normal rate, he was never observed to bring food to his secondary mate. Ultimately two young fledged from each brood, but fledging occurred a month later than normal in the second nest box. However, during the courtship of the grey-winged female in May, a second male was present twice and may have made some of the solo visits with her. Therefore it is possible that the female was also bigamous (polyandrous). Feather/tissue samples from some of the principle adults and all eggs and offspring are available for DNA analysis.

Albinism in Crested Caracara and other Raptors in Baja California Sur, México

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We report our observations of albinism on raptors in southern Baja California Peninsula. In spite of the great number of studies dealt with raptors that the second author have been performing in Baja California during the last 18 years, only few records of albinistic raptors have been observed. Animals having a degree of elimination of melanin from the eye, the skin and feathers, were considered albinos. These records were from incidental sightings while other studies were being made. We report the presence of albinism in three species, the Crested Caracara (*Caracara plancus*), the Turkey Vulture (*Cathartes aura*) and the Red-tailed Hawk (*Buteo jamaicensis*).

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The parasitic protozoan, *Trichomonas gallinae*, was identified as a significant source of mortality in nestling Cooper's Hawks (~40%) in Tucson, Arizona in 1995-1996, but <1% of breeding hawks were found to be infected. We sampled Cooper's Hawks from two age classes from February to June 2010 in Tucson to explore the possible role of oral pH in the observed differential rates of infection by *T. gallinae* between nestling and adult hawks. All sampled individuals had an oral pH measurement taken while in hand. A subsample were swabbed and subsequently cultured to assess the presence or absence of the disease Trichomoniasis. The average pH of breeding males was 6.31 ($n = 38$). Nestling males averaged 6.98 ($n = 57$), whereas nestling females averaged 7.02 ($n = 42$). pH is measured on a logarithmic scale, so a one unit increase in acidity indicates an environment which is 10 times



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more acidic. Of 20 cultured breeding males, none cultured positive for the parasitic protozoa. Of 24 nestling males and 21 nestling females 11.1% (four nestling males and one nestling female) cultured positive. These preliminary findings strongly contrast a previous study that reported 85% of nestlings were infected with *T. gallinae* in urban Tucson during 1995 and 1996. The positive cultures from this study will be maintained for a laboratory trial of the survivability of the protozoa under different environmental pHs. Trial environments will consist of modified diamond's medium manipulated to reflect the range of observed oral pHs of all sampled hawks. We also are currently sampling breeding female hawks, and will shortly begin sampling male and female fledglings. All samples will be obtained by the middle of August, so a more complete analysis will be prepared by the Raptor Research Foundation Conference.

Examination of Clinal Patterns of Black and White Tail Coloration for male American Kestrels (*Falco sparverius*) across the North American Continent

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Many species of raptor exhibit some form of plumage deviation or polymorphism, yet little is understood about why so many species of birds of prey maintain such wide ranging color variation. Explanations for many of the differences in plumage are often confounded by the exhibition of a highly vagile lifestyle and wide ranges, which can make it difficult to examine the entirety of the plumage variation for a species or subspecies. The American Kestrel exhibits high levels of both sexual dichromatism, and variability in individual coloration for specific plumage traits, such as the 6th rectrices of the male, as well as an extremely wide species range. In order to determine the degree and pattern of variation present in the tail coloration of

American Kestrels in North America, data was combined from museum specimens and wild caught birds from all major sections of the North American continent. Tail patterns were divided into six previously identified categories, and the frequency of each pattern, as well as the area (mm²) of black and white, was compared over different latitudinal and longitudinal areas. As attempts to explain clinal variation in plumage seen over large geographical ranges focus generally on environmental boundaries and ecological gradations, and the most differentiated forms are assumed to be found at the extremes of a species' geographic range, special attention was paid to the differences found in the tails of birds from along the Pacific Coast, the Southwest and east, and the northern limits of the North American continent. In addition, in order to look at the potential use of melanin for feather protection, comparisons were made between the area of melanin coloration present in the tails of birds from highly migratory populations, and from humid environments that may contribute to higher levels of feather degradation.



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