# Raptor Research Foundation 2014 Conference

## *September 24th-28th*
## *Corpus Christi, Texas*

## *Co-Hosts*

HawkWatch International

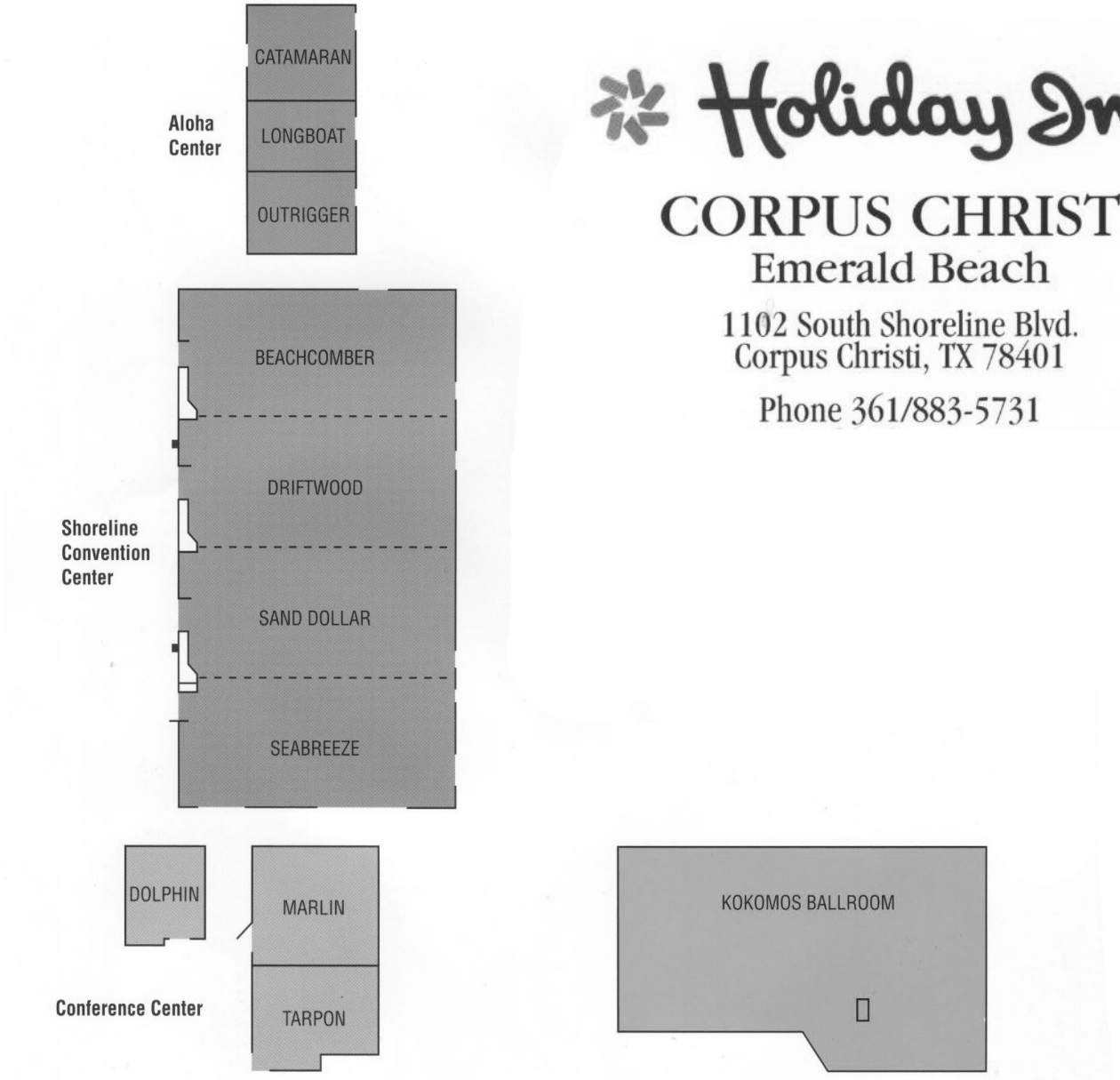
Caesar Kleberg Wildlife Research Institute
Texas A&M University-Kingsville

| THURSDAY | Beachcomber | Driftwood | Sand Dollar | Seabreeze |
|---|---|---|---|---|
| 8:00-9:00 | Keynote: G. Hunt, Welcome to Texas Raptors | Keynote: G. Hunt, Welcome to Texas Raptors | Vendors/breaks | |
| 9:00 | Break | Break | | |
| | **Raptors and Energy Development Symposium** | **Migration and Movements** | | |
| | **Moderator: Rick Harness** | **Moderator: Joan Morrison** | | |
| 10:00 | K. Kritz, Eagle Mortalities and Injuries on Power Lines | D. Brandes, The Raptor Population Index | | |
| 10:20 | C. Preston, Golden Eagles in Relation to Energy Development | D. Oleyar, Fall Migration and Climate Change | | |
| 10:40 | M. Braham, Golden Eagle Ranges and Renewable Energy | R. Phillips, A New Raptor Watch Site in Belize | | |
| 11:00 | E. Mojica, Brownian Bridges and Electrical Hazards | A. Franke, Migration Phenology of Peregrine Falcons | | |
| 11:20 | J. Luzenski, GIS and PLS-CADD Help Quantify Collision Risk | D. Brandes, Annotation of Raptor Telemetry Tracks | | |
| 11:40 | C. Kemper, Protecting Raptors in Working Landscapes | J. Kidd, Ranges and Migration of Rough-legged Hawks | | |
| *12:00-1:40* | *Lunch (poster setup in Seabreeze)* | *Lunch (poster setup in Seabreeze)* | | Poster set-up |
| | **Energy Symposium (cont.)** | **Migration, Movements, and Genetics** | | |
| | **Moderator: Diana Leiker** | **Moderator: Libby Mojica** | | |
| 1:40 | R. Harness, Endangered Ridgway's Hawk Electrocution | E. Bjerre, North Migration of Non-Breeding Golden Eagles | | |
| 2:00 | *(withdrawn) | T. Miller, Movements of juvenile Bald Eagles | | |
| 2:20 | *(withdrawn) | N. Smith, Movements of Louisiana Bald Eagles | | |
| 2:40 | N. Heck, Retrofitting Substations to Reduce Avian Risk | M. Judkins, Genetic Variation of Bald Eagles | | |
| *3:00* | *Break* | *Break* | | |
| | **Energy Symposium (cont.)** | **Genetics and Evolution** | | |
| | **Moderator: Rick Harness** | **Moderator: Jeff Smith** | | |
| 3:20 | C. Olsen, An Artificial Structure for Great-Horned Owls | W. Clark, Harlan's Hawk: a subspecies of Red-tailed Hawk? | | |
| 3:40 | A. Purevdorj, Electrocution of Raptors in Mongolia | T. Catanach, Insights in raptor phylogeny from their lice | | |
| 4:00 | J. Dwyer, Avian Protection Plan for White Sands Range | M. Mahmood, How Often Did Raptor Ecology Evolve? | | |
| 4:30 | *ECRR Mixer (hotel bar, 4:30-5:30 pm) | | | |
| 5:30-7:30 | | | | Poster Session reception |
| 7:30 | B. Clark - Eagle Quest | N. Dunlop, Megaflocks and Peregrines: Chaos in the Sky | | |
| 8:00 | | R. Palmer, Burrowing Owls to Bald Eagles: Rob Palmer's Best | | |

| FRIDAY | Beachcomber | Driftwood | Sand Dollar | Seabreeze |
|---|---|---|---|---|
| | **Andersen Award Session** | **Threatened, Endangered, and Declining Species** | Vendors/breaks | |
| | **Moderator: Clint Boal** | **Moderator: Jessi Brown** | | |
| 8:00 | A. Huang, Genetics of Barn Owls in North America | *(withdrawn) | | Poster Session on-going |
| 8:20 | K. Linner, Seasonal Raptor Occurrence and Wind Energy | J. Salgado-Ortiz, Conservation of Strigidae in Mexico | | |
| 8:40 | V. Morandini, Floater Interference and Fecundity in Eagles | T. Booms, Assessing Conservation of Short-eared Owls | | |
| 9:00 | J. Ng, Agriculture and Energy Impacts on Ferruginous Hawks | D. Keddy Hector, Review of Aplomado Falcon Conservation | | |
| 9:20 | J. Wade, Response of Burrowing Owls to Brood Parasitism | S. Hindmarch, Anticoagulant Rodenticides in Raptors | | |
| *10:00* | *Break* | *Break* | | |
| | **American Kestrel Symposium** | **Threatened, Endangered, and Declining Species (cont.)** | | |
| | **Moderator: Chris McClure** | **Moderator: Rob Bierregaard** | | |
| 10:20 | C. McClure, Lessons from American Kestrel Nest Boxes | D. Bohra, Poisoning of Gyps Vultures in India | | |
| 10:40 | R. Van Buskirk, Land Use and Breeding Success of Kestrels | J. Dwyer, Communal Roosting of Crested Caracaras | | |
| 11:00 | J. Brown, Temperate vs. Subtropical Nest Survival | S. Ahmed, Monitoring and Conserving Egyptian Vultures | | |
| 11:20 | J. Smallwood, Researcher-Induced Nest Box Disturbance | J. Gallardo, Extinction Risk for Puerto Rican Sharp-shinneds | | |
| 11:40 | J. Klucsarits, Additional Nest Boxes Increase Productivity | J. Morrison, Understanding Transmitter Technology | | |
| *12:00-1:40* | *Lunch* | *Lunch* | | Poster take-down |
| | **American Kestrel Symposium (cont.)** | **Anthropogenic Impacts** | | |
| | **Moderator: Chris McClure** | **Moderator: Carol McIntyre** | | |
| 1:40 | E. Wommack, Male Behavioral Use of Varied Tail Coloration | B. Washburn, Eagle-Aircraft Collisions | | |
| 2:00 | J. Salgado-Ortiz, Sexual Segregation of Habitat in Mexico | L.M. Wang, Retrospective Analysis of Raptor Rehabilitation | | |
| 2:20 | J. Sherburne, Bioavailability of Antimicrobials in Eggs | M. Green, Delisting Results for Peregrine Falcons 2003-2012 | | |
| *2:40* | *Break* | *Break* | | |
| 3:00 | RRF business meeting (open) | | | |
| 4:30-9:00 | | | | Kleberg dinner/tour |

| SATURDAY | Beachcomber | Driftwood | Sand Dollar | Seabreeze |
|---|---|---|---|---|
| | **Coastal Raptors Symposium** | **Breeding Ecology** | Vendors/breaks | |
| | **Moderator: Dan Varland** | **Moderator: Jim Bednarz** | | |
| 8:00 | D. Varland, Coastal Raptors Symposium | J. Larson, Breeding Ecology of Northern Hawk Owl | | |
| 8:20 | P. Sharpe, Restoration of Bald Eagles on Channel Islands | J. Bednarz, Reducing Predation in a Canopy-nesting Raptor | | |
| 8:40 | B. Mutch, Restoring Aplomado Falcons to the United States | B. Clark, Breeding Group Size of Harris's Hawks in Texas | | |
| 9:00 | T. Maechtle, Long-term Studies of Migrating Peregrine Falcons | F. Atuo, Spatially Explicit Densities of Prairie Raptors | | |
| 9:20 | T. Maechtle, Peregrine Falcons Accumulate Hydrocarbons | K. Howard, Habitat selection by Black-shouldered Kites | | |
| 9:40 | S. Lewis, Peregrine Falcon Subspecies on the Gulf of Alaska | C. Vennum, Immunocompetence in Swainson's Hawks | | |
| *10:00* | *Break* | *Break* | | |
| | **Coastal Raptors Symposium (cont.)** | **Techniques** | | |
| | **Moderator: Dan Varland** | **Moderator: Brian Washburn** | | |
| 10:20 | W. Nelson, Nestling Weights in Peregrines and Vultures | C. McIntyre, Consistent Use of Terms in Raptor Ecology | | |
| 10:40 | A. Franke, Breeding Ecology of Nunavut Peregrine Falcons | *(withdrawn) | | |
| 11:00 | S. Heinänen, Modeling Flight of Raptors Crossing Water | M. Larson, Detection of Short-eared Owls | | |
| 11:20 | K. Meyer, Use of Peripheral Wetlands by Snail Kites | B. Skipper, Evaluation of Golden Eagle Survey Protocols | | |
| 11:40 | J. Gallardo, Foraging by Snail Kites in Veracruz, Mexico | | | |
| *12:00-1:40* | *Lunch* | *Lunch* | Vendor take-down | |
| | **Coastal Raptors Symposium (cont.)** | | | |
| | **Moderator: Dan Varland** | | | |
| 1:40 | R. Bierregaard, Ospreys and Humans in New England | | | |
| 2:00 | B. Drahota, Abundance and Habitat of Virginia Bald Eagles | | | |
| *2:20* | *Break* | *Break* | | |
| | **Keynote** | **Keynote** | | |
| 2:40-3:40 | S. Hoffman, A Lifetime of Migration | S. Hoffman, A Lifetime of Migration | | |
| 6:30-9:00 | | | **Banquet** | |

| WEDNESDAY | Beachcomber | Driftwood | Seabreeze | Longboat | Outrigger | Kokomos |
|---|---|---|---|---|---|---|
| Morning Session | APLIC workshop<br>8:30 am - 12 pm<br>(1 hour lunch breack) | ECRR: Raptor field & in-hand ID, ageing & sexing, molt and its use in ageing, and recent taxonomic changes in raptors<br>8:30 am - 4:30 pm (1 hr lunch break)<br>am: in room; pm: off-site<br>_____<br>ECRR: Safely Accessing Raptor Nests<br>1-4:30 pm<br>meet in room before departing | ECRR: Harnessing Raptors with Transmitters<br>8:30 am - 12 pm | ECRR: Techniques for Handling, Auxiliary Marking, Measuring, and Blood Sampling Raptors after Capture: A Bird in the Hand is Worth Two in the Bush<br>8:30 am - 12 pm | RRF Board meeting | |
| Afternoon Session | APLIC workshop<br>1-4 pm<br>(1 hour lunch breack) | Wind Energy and Raptors workshop<br>1-4:30 pm | ECRR: Raptor Trapping and Handling Techniques for Scientific Research<br>1-4:30 pm | ECRR: Raptor Necropsy<br>1-4:30 pm | RRF Board meeting | Icebreaker<br>6-8 pm |




Holiday Inn®

CORPUS CHRISTI
Emerald Beach

1102 South Shoreline Blvd.
Corpus Christi, TX 78401

Phone 361/883-5731

## Raptor Research Foundation

**www.raptorresearchfoundation.org**

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 1,000 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.

## HawkWatch International

**www.hawkwatch.org**

HawkWatch International (HWI) was founded in 1986 as the first organization to conduct long-term, standardized migration counts of raptors throughout the western U.S. Over the years, their efforts to sustain and protect these remarkable creatures have expanded to study and learn from them during all aspects of their lives, from spring nesting to fall migration and winter survival. Education has been a critical component of HWI's mission and conservation efforts since it's founding. HWI has welcomed thousands of individuals and groups to their migration sites over the years, and reached thousands more through in-school and community-based outreach programs with their non-releasable education birds that teach about raptor biology, ecology, and conservation.

## Caesar Kleberg Wildlife Research Institute at Texas A&M University—Kingsville

**www.ckwri.tamuk.edu**

The Caesar Kleberg Wildlife Research Institute at Texas A&M University-Kingsville is the leading wildlife research organization in Texas and one of the finest in the nation. Its mission is to provide science-based information for enhancing the conservation and management of wildlife in South Texas and related environments.

The Raptor Research Foundation Conference organizers and participating organizations are grateful to our sponsors.

## WE THANK YOU VERY MUCH FOR YOUR SUPPORT!

Caesar Kleberg WILDLIFE Research Institute
Texas A&M University-Kingsville

Avian Power Line Interaction Committee

POWER ENGINEERS

TEXAS STATE AQUARIUM.

POWER LINE SENTRY

DEPARTMENT OF ENERGY
UNITED STATES OF AMERICA

TEXAS PARKS & WILDLIFE

**Stop by the Sand Dollar room Thursday, 8:00 am through Saturday, 12:00 pm to see what our conference vendors have to offer.**

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**Cantega Technologies** | www.cantega.com
Cantega Technologies designs and manufactures dielectric polymer covers to protect power substation and distribution equipment from animal-caused outages, thus increasing system reliability.

**BlueSky Helicopters** | www.blueskyhelo.com
BlueSky Helicopters in Redlands, CA is committed to building ongoing partnerships with our clients. It is our goal to provide superior, safe, and dedicated helicopter services to our customers while maintaining exceptional value.

**Lotek Wireless Corporation** | ww.wlotek.com
Lotek is a world leader in the design and manufacture of fish and wildlife monitoring systems. Our innovative and internationally recognized radio, acoustic, archival and satellite monitoring solutions allow researchers to track animals, birds and fish of almost any size, in almost any environment.

**EDM International** | www.edmlink.com
EDM has become a leader in the electric utility, construction and forest products industries by merging excellence in engineering and science with a genuine concern for our clients' needs. EDM is committed to producing results that are expected of industry leaders.

**Rob Palmer Photography** | www.falconphotos.com
Rob is an internationally award-winning wildlife photographer with a passion for birds of prey. He has spent a large part of his life studying raptors and refining his photography techniques.

**Nick Dunlop Photography** | www.nickdunlop.com
Nick is a wildlife photographer and naturalist whose goal is to capture images of wildlife, primarily birds of prey, in natural settings.

# Raptor Research Foundation Board of Directors

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Brian E. Washburn, Editor of Wingspan

Libby Mojica, Website Coordinator

# Raptor Research Foundation Committee Chairs

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Kate Davis, Conference Committee Chair

Rick Watson, Conservation Committee Co-chair

Joan L. Morrison, Conservation Committee Co-chair

Travis L. Booms, Early Career Raptor Researchers Committee Chair

Jeremy Scheivert, Education Committee Chair

Michael N. Kochert, Finance Committee Chair

Ted Swem, Membership Committee Chair

James Dwyer, Scientific Program Committee Chair

Open, Nominations Committee Chair

Many thanks to the following contributors for volunteering their time and talents to make this event possible (sorry for any we may have missed in this list). Thanks to Joseph Dane for designing and creating the program book. Thanks to James Dwyer, Miguel Saggese, and Dan Varland for editing. Special thanks to Kate Davis for chairing the conference committee, creating the conference logo, and contributing photos. Thanks to Rob Palmer and Nick Dunlop for contributing photos.

# THANK YOU!

## Conference Committee

Kate Davis, Chair
Dan Varland
Rick Harness
J.D. Dwyer
Tom Langschied
Joseph Dane
Joe Platt
David Stelling
Barbara Rapstein

## Conference Moderators

Jim Bednarz
Rob Bierregaard
Clint Boal
Jessi Brown
Rich Harness
Diana Leiker
Chris McClure
Carol McIntyre
Libby Mojica
Joan Morrison
Jeff Smith
Dan Varland
Brian Washburn

## Conference Volunteers

<u>Graduate Students</u>

Andrea Bruno (Texas A&M, Kingsville)
Monika Burchette (Texas A&M, Kingsville)
Carter Crouch (Texas A&M, Kingsville)
Helen Davis (Texas A&M, College Station)
Danielle deVacque (Texas A&M, Corpus Christi)
Teresa Ely (University of Nebraska, Lincoln)
Nate Huck (Texas A&M, Kingsville)
Corey Lange (Texas A&M, Kingsville)
Maia Lipschutz (Texas A&M, Kingsville)
Lianne Koczur (Texas A&M, Kingsville)
Katherine Miller (Texas A&M, Kingsville)
Andrew Olsen (Texas A&M, Kingsville)
Janel Ortiz (Texas A&M, Kingsville)
Caroline Ward (Texas A&M, Kingsville)

<u>Local Community</u>

Audubon Outdoor Club of Corpus Christi
Coastal Bend Audubon Society
Gene Blacklock
Jeanetta Caplan
Sibyl Deacon
Joel Simon
Kathy Seiczkowski

CORPUS CHRISTI
CONVENTION & VISITORS BUREAU

101 N. Shoreline Boulevard | Suite 430 | Corpus Christi, TX 78401 | 361.881.1888 | VisitCorpusChristi.org

September 24, 2014

Dear Raptor Research Foundation Conference Attendees:

Welcome to beautiful Corpus Christi, Texas! It is an honor to host your organization and we anticipate every member being our special guest.
Corpus Christi offers a spectacular bayfront setting that all delegates are sure to enjoy. With an enticing combination of sunny weather, a savory selection of cuisines, unique fun-filled attractions, and cultural venues, the conference and activities will undoubtedly be a tremendous success. Consider the following experiences during your stay:

Texas State Aquarium
Located on North Beach, this stunning complex is home to more than 250 species from dolphins to spiders. Feeling adventurous? Hold a hermit crab or touch a stingray as it swims past you.

U.S.S. Lexington
History comes alive aboard the U.S.S. Lexington! Featuring a flight simulator and on-board movies at the 3D Mega Theater, your visit to this World War II naval aircraft carrier will be anything but ordinary. Explore dark corridors and colossal compartments while gathering interesting facts during a self-guided tour. Guests can explore several airplanes that sit on its flight deck.

Art Museum of South Texas
Culture and art merge at the Art Museum of South Texas. Offering diverse exhibits featuring local and national artists, the Art Museum of South Texas is a wonderful place to tour during a leisurely afternoon.

La Palmera & the Shops at La Palmera
Indulge in a shopping spree at Corpus Christi's most popular shopping destination featuring well-known stores.

Please be assured that we are dedicated to providing services that will create a favorable and lasting impression for each of you. If we can be of any assistance to you or answer any questions, please do not hesitate to contact our offices at 361-561-2000 or 1-800-766-2322. Stop by and see us at the prettiest Visitor Information Center in the state located along the Corpus Christi Bayfront at 1400 N. Shoreline Blvd. You will find maps, brochures, T-shirts, snacks and drinks.

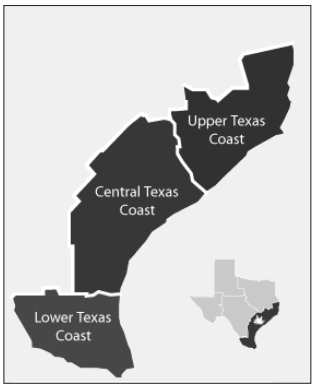
Kindest regards,

Paulette Kluge
Chief Executive Officer

CORPUS CHRISTI
CONVENTION & VISITORS BUREAU

Corpus Christi has been named "America's Birdiest City" every year since 2003. The Corpus Christi area includes a number of sites that are on the Mustang Island Loop and the Corpus Christi Bay Loop of the Great Texas Coastal Birding Trail. So grab your birding gear and head to the Central Texas Coast trails!

Great Texas Coastal Birding Trail




The coastal birding trail has it all. Plus, conveniences such as boardwalks, parking pullouts, observation platforms, and landscaping to attract native wildlife allow you to get closer to see Texas's breathtaking birds. There are three coastal birding maps to send you on a well-rounded tour of the coast's top birding sites. The Upper Coast map covers driving loops from the Louisiana border, through the Houston and Beaumont coastal areas, and down to Brazosport. **The Central Coast map** starts near Matagorda Bay, traveling through the Victoria and Corpus Christi areas, and ends just south of Kingsville. The Lower Coast map encompasses the southern tip of Texas along the border with Mexico, from South Padre Island, through Brownsville, Harlingen, and McAllen, and west towards Laredo. The Great Texas Coastal Birding Trail maps are a great way to enjoy your time on the Gulf Coast. Access the coastal birding trail maps on the Texas Parks and Wildlife Department's website.
http://www.tpwd.state.tx.us/huntwild/wildlife/wildlife-trails/coastal

Local Hawkwatching

The Texas coast is home to two long-term hawkwatch sites: the Hazel Bazemore County Park site operated by HawkWatch International, and the Smith Point site operated by Gulf Coast Bird Observatory in partnership with HawkWatch International and Texas Parks & Wildlife Department. These Texas coast hawkwatch sites boast the highest counts of any standardized migration site in North America. Hazel Bazemore can exceed 1 million migrants, with about 90 percent of those being Broad-winged Hawks and Mississippi Kites. It is no coincidence the 2014 RRF conference is hosted in Corpus Christi and timed with peak Broad-winged flight. Don't miss your opportunity to see these massive flights; make plans to **visit the Hazel Bazemore County Park site during our official field trip on Sunday (shuttle bus service is provided for $10 and will pick-up outside of the hotel starting at 6am-2pm).**

King Ranch Birding

EST. 1853
KING RANCH

With 825,000 acres of varied habitat, the King Ranch is a haven for birds and birdwatchers alike. Named as a site on the Great Texas Coastal Birding Trail and as a Globally Important Bird Area by the American Bird Conservancy, the ranch boasts a bird list of 356 species. As one of the premier birding destinations in South Texas and the country, the King Ranch offers a wide variety of birding opportunities. To learn more about available King Ranch birding tours, visit the nature tour page.
www.king-ranch.com/visit/nature-tours

## Hazel Bazemore County Park

Sunday, September 28 | 8 am - 3 pm | $10

HawkWatch International has been conducting standardized, fall migration counts at the Hazel Bazemore Park since 1997. This migration site boasts the largest concentration and diversity of migrating raptors in the U.S. The majority of 100,000 count days have occurred between Sept 25 and 29, so you are here at the right place, at the right time. There will be other events in the park in honor of the annual "Celebration of Flight" festival, which occurs this weekend during peak Broad-winged Hawk migration. There are plenty of other birding spots throughout the park, so come early and enjoy.

$10 covers your shuttle service from Emerald Beach Hotel to the park and can be purchased at the shuttle. It's a 20-30 minute drive between the hotel and park, and the shuttle will make continuous loops starting at 8 am with the last return shuttle from the park at 3 pm (there will be a shuttle service break from 11-1). Water and snacks will be sold at the park, but there is no convenient place to get lunch so plan ahead. For more information on the Hazel Bazemore Park migration site and HawkWatch International's 17 years of research at this site, visit their website at www.hawkwatch.org.

## King Ranch Field Trip

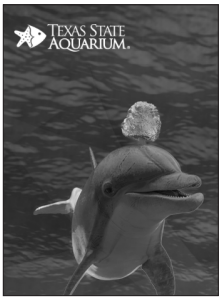
Sunday, September 28 | 6:30 am - 12:30 pm | $60

Come and explore the vast and historic King Ranch! Upon arrival, this 3.5 hour tour will visit the Santa Gertrudis Division, one of four sections of this 825,000 acre ranch, which has a variety of upland and wetland habitats. Some of the many possible raptors that could be encountered include White-tailed Kite, Crested Caracara, Harris', Swainson's, and White-tailed Hawks. Some of the unique "tropical" birds possible at this time of year include Groove-billed Ani, Couch's Kingbird, Great Kiskadee, Green Jay, Long-billed Thrasher, and Olive Sparrow.

You will take the shuttle bus from the Emerald Beach Hotel to Hazel Bazemore Park at 6am, with van pick-up at the park taking you to the King Ranch. This field trip will depart via the shuttle bus from Hazel Bazemore Park at 7am, with return at 2pm. This field trip will include drinks and snacks (plan on packing your own lunch), and has a 20 person capacity. Check with the registration desk for available space if you have not already registered. For more information on the King Ranch, visit their website at www.king-ranch.com.

## Texas State Aquarium

At your leisure | discount tickets




Visit one of the Top 10 Aquariums in North America! Texas State Aquarium is a close 10 minute drive from the Emerald Beach Hotel. Admissoin for RRF conference attendees is just $13.95 (discount ticket coupon inside your registration bag). Special exhibits include the Nearshore Experience, Eagle Pass, Living Shores, and many more. Don't miss the Hawn Wild Flight Theater featuring trained birds in flight delivering conservation messages. View the full exhibit list and learn more at www.texasstateaquarium.org. The mission of the Texas State Aquarium is to connect people with nature and inspire conservation of the Gulf of Mexico.

## Avian Power Line Interaction Committee (APLIC) Workshop

The purpose of this workshop is to provide training and informational resources to wildlife professionals that work on electric utility projects such as Avian Protection Plans or new transmission line construction projects. This course will provide an overview of avian interactions with power lines, including discussion on Avian Protection Plans (APPs) and Avian Power Line Interaction Committee (APLIC) guidance documents. The course will review the causes of bird electrocutions and collisions with power lines, regulations protecting migratory birds, current measures to reduce bird mortality associated with power lines, management of raptor nests on power lines, methods to minimize impacts to birds associated with construction activities, and the development of APPs that allow utilities to protect migratory birds while enhancing power reliability. APLIC is a partnership that works with utilities, resource agencies, and the public to: develop and provide educational resources; identify and fund research; develop and provide cost-effective management options; and serve as the focal point for electric utility avian interaction issues. Course participants will receive copies of current APLIC guidance documents. APLIC workshop attendees are encouraged to attend the Raptors and Energy Development Symposium on Thursday for continued discussion on this and related topics.

Avian Power Line Interaction Committee

Moderator:
Date: Wed., 9/24 | Time: 1:00-4:30 (with a 1-hour lunch break) | Cost: $60

## Wind Energy and Raptors Workshop

Renewable energy provides a benefit to wildlife by reducing atmospheric carbon but can create a risk to raptors if not sited and operated correctly. This workshop will focus on how biologists and developers can better protect birds of prey while successfully creating wind energy projects. Speakers will include project developers, resource agencies, and biologists. Specific project experiences will be presented. Panels featuring developers and researchers will field questions. Attendees of this workshop are encouraged to attend the Raptors and Energy Development Symposium on Thursday for continued discussion on this and related topics.

POWER ENGINEERS

Moderator: Joseph Platt, Ecologist for POWER Engineers Inc.
Date: Wed., 9/24 | Time 1:00-4:30 (with a 1-hour lunch break) | Cost: free

## ECRR Workshops

These workshops are sponsored by the Early Career Raptor Researcher Committee of RRF, and provide hands-on training to students and early career researchers interested in learning more about raptor research techniques.

**Techniques for Handling, Auxiliary Marking, Measuring, and Blood Sampling Raptors after Capture: A Bird in the Hand is Worth Two in the Bush**

Course Description: This course will give students hands-on experience in applying the following types of auxiliary markers to raptors: conventional US Geological Survey leg bands, colored leg bands, leg flags, patagial markers, dyes, and feathers (through feather imping). Students will also have the opportunity to learn and practice proper handling, measuring and blood sampling techniques. This class will be taught at the Emerald Beach Hotel (conference venue).
Instructor: Dan Varland, Coastal Raptors; Eugene Jacobs, Linwood Springs Research Station; Wayne Nelson; and John Smallwood, Montclair State University.
Date: Wed., 9/24 | Time: 8:30-12:00 | Class size: 20 students | Cost $20

**Harnessing Raptors with Transmitters**
Course Description: This class will cover the process of attaching a transmitter (either VHF or satellite) to raptors, from initial thoughts of the bird's welfare to specifics of making harnesses and attaching them to birds. The majority of the class will be hands-on, involving creation of a backpack-style harness and using that harness to attach a transmitter to carcasses of different sized raptors. As time allows, we may discuss other attachment techniques (e.g., tailmount, patagial) as well as thoughts on data management. Class will be taught at the Emerald Beach Hotel (conference venue).
Instructors: Steve Lewis and Brian Millsap, US Fish and Wildlife Service
Date: Wed. 9/24 | Time: 8:30-12:00 | Class size: 16 students | Cost: $20

**Safely Accessing Raptor Nests**
Course Description: This class will cover the following topics: safety (climber and raptors), gear and use, basic knots, rappelling, ascending fixed ropes, getting into nests, and bird handling while aloft. Much of the course emphasis will be on expedient ascent on fixed ropes to access nest sites, quickly but safely transferring to rappel gear, and then safely rappelling. Class will be taught at a local climbing wall or outdoor facility with strong emphasis on experiential learning while hanging from ropes. At this time, we believe climbing harnesses will be provided, but bring your own and your favorite rappel device if you have one.
Instructor: Joel Pagel, US Fish and Wildlife Service
Date: Wed. 9/24 | Time: 1:00-4:30 | Class size: 6 students | Cost: $20

**Raptor Necropsy**
Course Description: This class will focus on techniques for getting research quality data through tissue samples and field necropsies on dead raptors. Students will learn how and where to collect tissue samples and conduct field necropsies on raptor carcasses of various sizes. This class will be taught at the Emerald Beach Hotel (conference venue).
Instructor: David Stelling, Texas State Aquarium
Date: Wed., 9/24 | Time: 1:00-4:30 | Class size: 16 students | Cost: $20

**Raptor Trapping and Handling Techniques for Scientific Research**
Course Description: This class will discuss safe trapping and handling methods, including the use of the Bal-chatri, Dho-Ghaza, bow nets, and other methods. Permitting, health and welfare of birds, trap construction, noose tying, and trap use will be covered, including hands-on instruction. This class will be taught at the Emerald Beach Hotel (conference venue).
Instructor: Pete Bloom, Western Foundation of Vertebrate Zoology
Date: Wed., 9/24 | Time: 1:00-4:30 | Class size: 16 students | Cost: $20

**Raptor field & in-hand ID, ageing & sexing, molt and its use in ageing, and recent taxonomic changes in raptors**
Course Description: This class will begin with an overview of the ID of diurnal raptors, followed by a summary by species of field ID of North American ones using field marks for perched and flying birds. Then raptor in-hand ID will be covered, along with ageing and sexing. Molt of the remiges and its use in ageing, especially of Accipitrid raptors, will be explained next. The workshop will end with a discussion of recent changes in taxonomy of raptors, especially changes in scientific names, most as result of DNA analyses. The morning session will be held at the Emerald Beach Hotel (conference venue). During the afternoon session, we will go to the official hawk count at Hazel Bazemore County Park for hawk watching and practice of new ID skills.
Instructor: Bill Clark, Raptours
Date: Wed., 9/24 | Time: 8:30-4:30 (with a 1-hour lunch break) | Class Size: 12 students | Cost: $20

**Wednesday, September 24**

| | |
|---|---|
| 6:00-8:00pm | Icebreaker Reception (Kokomos) |

**Thursday, September 25**

| | |
|---|---|
| 8:00-9:00 am | Special Speaker, Grainger Hunt, "Welcome to Texas Raptors" (Beachcomber/Driftwood) |
| 8:00 am -4:00 pm | Vendors (Sand Dollar) |
| 10:00 am-4:30 pm | Raptors and Energy Development Symposium (Beachcomber) |
| 4:30-6:30 pm | ECRR Mixer (hotel bar) |
| 5:30-7:30 pm | Poster Session reception (Seabreeze) |
| 7:30-8:00 pm | "Eagle Quest" by William Clark (Beachcomber) |
| 7:30-8:00 pm | Photography Presentation: "Megaflocks and Peregrines: Chaos in the Sky" by Nick Dunlop (Driftwood) |
| 8:00-8:30 pm | Photography Presentation: "Burrowing Owls to Bald Eagles" by Rob Palmer (Driftwood) |

**Friday, September 26**

| | |
|---|---|
| 10:00-2:40 pm | American Kestrel Symposium (Beachcomber) |
| 8:00 am-4:00 pm | Vendors (Sand Dollar) |
| 8:00 am -12:00 pm | Poster Session (Seabreeze) |
| 3:00-4:00 pm | RRF Business Meeting (Beachcomber) |
| 4:30-9:00 pm | Kleberg Dinner/Tour (offsite) |

**Saturday, September 27**

| | |
|---|---|
| 8:00 am -2:20 pm | Coastal Raptors Symposium (Beachcomber) |
| 8:00 am -12:00 pm | Vendors (Sand Dollar) |
| 2:40-3:20 pm | Special Speaker, Steve Hoffman, "A Lifetime of Migration" (Beachcomber/Driftwood) |
| 6:30-9:00 pm | Banquet and Photography Competition (Sand Dollar) |

**Sunday, September 28**

| | |
|---|---|
| 6:30 am -12:30 pm | King Ranch field trip (see page 8 for details) |
| 8:00 am -3:00 pm | Hazel Bazemore Park field trip (see page 8 for details) |
| at your leisure | Texas State Aquarium field trip (see page 8 for details) |

## Thursday, September 25

8:00-8:30 am Announcements and Introduction (Beachcomber/Driftwood)
**8:00-9:00 am** **Keynote: Welcome to Texas Raptors, Grainger Hunt**
*9:00-10:00 am* *Coffee Break*

**CONCURRENT GENERAL SESSION I** **Driftwood**
**Migration and Movements | Moderator: Joan Morrison**

10:00 am D. Brandes, The Raptor Population Index
10:20 am D. Oleyar, Fall Migration and Climate Change
10:40 am R. Phillips, A New Raptor Watch Site in Belize
11:00 am A. Franke, Migration Phenology of Peregrine Falcons
11:20 am D. Brandes, Annotation of Raptor Telemetry Tracks
11:40 am J. Kidd, Ranges and Migration of Rough-legged Hawks
*12:00-1:40 pm* *Lunch*

**CONCURRENT GENERAL SESSION II** **Driftwood**
**Migration, Movements, and Genetics | Moderator: Libby Mojica**

1:40 pm E. Bjerre, North Migration of Non-Breeding Golden Eagles
2:00 pm T. Miller, Movements of juvenile Bald Eagles
2:20 pm N. Smith, Movements of Louisiana Bald Eagles
2:40 pm M. Judkins, Genetic Variation of Bald Eagles
*3:00-3:20 pm* *Break*

**CONCURRENT GENERAL SESSION III** **Driftwood**
**Genetics and Evolution | Moderator: Jeff Smith**

3:20 pm W. Clark, Harlan's Hawk: a subspecies of Red-tailed Hawk?
3:40 pm T. Catanach, Insights in raptor phylogeny from their lice
4:00 pm M. Mahmood, How Often Did Raptor Ecology Evolve?

**SYMPOSIUM CONCURRENT SESSION I** **Beachcomber**
**Raptors and Energy Development Symposium | Moderator: Rich Harness and Diana Leiker**

10:00 am K. Kritz, Eagle Mortalities and Injuries on Power Lines
10:20 am C. Preston, Golden Eagles in Relation to Energy Development
10:40 am M. Braham, Golden Eagle Ranges and Renewable Energy
11:00 am E. Mojica, Brownian Bridges and Electrical Hazards
11:20 am J. Luzenski, GIS and PLS-CADD Help Quantify Collision Risk
11:40 am C. Kemper, Protecting Raptors in Working Landscapes
*12:00-1:40 pm* *Lunch*
1:40 pm R. Harness, Endangered Ridgway's Hawk Electrocution
2:00 pm (withdrawn)
2:20 pm K. Martin, Protection of California Condors at Wind Farms
2:40 pm N. Heck, Retrofitting Substations to Reduce Avian Risk
*3:00-3:20 pm* *Break*
3:20 pm C. Olsen, An Artificial Structure for Great-Horned Owls
3:40 pm A. Purevdorj, Electrocution of Raptors in Mongolia
4:00 pm J. Dwyer, Avian Protection Plan for White Sands Range

**POSTER SESSION** **5:30-7:30 pm** **Seabreeze**

*Jarod Armenta, James F. Smith, Muhammad Arshad, Jim Belthoff
**Microsatellite Analysis of Parentage in Western Burrowing Owls Nesting in the Morley Nelson Snake River Birds of Prey National Conservation Area, Idaho, U.S.A.**

*Christopher P. Barger, Travis l. Booms, Stephen B. Lewis, Carol L. McIntyre
**A Preliminary Analysis of Golden Eagle Movements in Alaska**

*Christopher W. Briggs, Jill A. Harley, and Allen M. Fish
**Anticoagulant Rodenticide Occurrence in Red-tailed Hawks in Coastal California**

*Krishna Prasad Bhusal, Munir Z. Virani, Hemanta Dhakal
**Ecological Research and Monitoring of Threatened Vultures in Arghakhanchi, Nepal**

*Jason Brogan, David Green, Kristine Kirkby, John Elliott
**Home Range and Land Use of Urban Cooper's Hawks in Vancouver, British Columbia**

Philip J. Capitolo, Lynn Jesus, William J. James, Jill A. Harley, *Allen M. Fish, Buzz C. Hull
**Fall Migration of Radio-tagged Broad-winged Hawks in California**

Jeffrey P. Dalla Rosa, *Rick E. Harness, Donna Anderson
**Relocation of a Bald Eagle (Haliaeetus leucocephalus) from a Nest in a Dead Tree Near Electric Distribution Power Lines in Houston, Texas U.S.A.**

*James F. Dwyer, Jeffrey P. Dalla Rosa
**Use of Anthropogenic Nest Substrates by Crested Caracaras**

**Joseph M. Eisaguirre, Travis L. Booms, Philip F. Schempf, Steven B. Lewis
**Gyrfalcon (Falco rusticolus) Movements and Home Ranges on the Yukon-Kuskokwim Delta, Alaska**

Jerome Fuchs, *Jeff A. Johnson, David P. Mindell
**Rapid Diversification of Falcons (Aves: Falconidae) Due to Expansion of Open Habitats in the Late Miocene**

*Gregory George, Reginald Hoyt, Brandon Swayser
**Diet and Roost Tree Characteristics of a Long-Eared Owl (Asio otus) Winter Roost Location in Pennsylvania: An Opportunity for Undergraduate Raptor Research**

**Laurie Groen, Clint Boal, James D. Ray, Jimmy Walker
**Movement Rates of Swainson's Hawks from the Plains of Texas to the Pampas of Argentina**

*Sofi R. Hindmarch, John E. Elliott
**A Specialist in the City: The Hunting Behavior and Diet of Barn Owls (Tyto alba) Along a Rural to Urban Gradient**

*Dean P. Keddy-Hector, David D. Diamond, Dyanna L. Pursell
**The Distribution of Potential Northern Aplomado Falcon (Falco femoralis septentrionalis) Habitat in Mexico**

**Ariana La Porte
**Water Limitation and Gray Hawk Diet on the San Pedro River**

*Kerrie Anne T. Loyd, Joseph J. Osinski, Savanna S. Bailey, Ruth Anne Ford
**Habitat Characteristics and Nesting Success of the Western Burrowing Owl (Athene cunicularia) in a Suburban Desert Landscape**

*Jody Millar
**The American Eagle Foundation Eagle Grants Will Award About $100,000 for Bald Eagle (Haliaeetus leucocephalus) Conservation Work in 2015**

*Brian Millsap, Robert Murphy, Kristin Madden, Mark Brennan, David Campbell, Gregory Hughes
**Does Annual Home Range Size Decrease with Age among Female Cooper's Hawks (Accipiter cooperii)?**

*Elizabeth K. Mojica, Bryan D. Watts
**Creation of a National Eagle Roost Registry**

*Abe Manabu
**Habitat Selection and Food Habits of three Species of Raptors (Aquila chrysaetus, Nisaetus nipalensis, and Accipiter gentilis) in Japan**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*Rebecca Perkins, Clint Boal
**Transmitter Influences on Raptor Agility and Avian Prey Selection**

*Ryan Phillips, Roni Martinez, Manuel Sanchez, Marcial Cordova, Andrew Bradshaw, Charles Britt
**Nest and Nest-Site Characteristics and Prey of Solitary Eagles (Buteogallus solitarius)**

*Erin Pikcilingis, Steven Hanser, Jeremy Thompson, Connor Badten, Eric Yensen, Angela Kociolek, Melinda Lowe, Jim Belthoff
**Relationships Between Prey Abundance and Barn Owl-Vehicle Collisions Along U.S. Interstate Highway 84 in Southern Idaho**

*Sara M. Pourzamani, Jamie L. Wade, Skyler Wysocki, Jill Holderman, Jim Belthoff
**Assessment of Road Proximity, Land Use, and Power Transmission Lines on Characteristics of Predator and Scavenger Visits to Burrowing Owl Nests in the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA), Idaho**

*Tempe Regan, Christopher J.W. McClure, Angela Kociolek, Melinda Lowe, Jim Belthoff
**Modeling Occupancy of Barn Owls in Southern Idaho, U.S.A. in Relation to Roadway Mortality**

*Bryce W. Robinson, David L. Anderson, Travis Booms, Marc Bechard
**Motion-Activated Cameras to study Cliff Nesting Raptors: New Installation Methods, With Tips to Reduce Cost and Disturbance**

*Jack Service, Kiisa Nishikawa
**Observations of a Juvenile Red-tailed Hawk (Buteo jamaicensis) Preying on Western Diamondback Rattlesnakes (Crotalus atrox)**

**Stephanie J. Szarmach, Robert A. Miller, Jay D. Carlisle, Gregory S. Kaltenecker, Muhammad Arshad, James F. Smith
**Northern Goshawk (Accipiter gentilis) Genetic Diversity and Connectivity Among the Naturally Fragmented Forests of the Northern Great Basin, U.S.A.**

*Oluwakemi Taiwo
**The Ecological Role, Foraging Behavior, and Economic Importance of Barn Owls to Human Communities of Kainji Lake National Park, Nigeria**

Robin Warne, *Glenn A. Proudfoot, Erica Crespi, Emma Young
**Integrating Nutritional Ecology, Endocrine Ecophysiology, Ecoimmunology and Geospatial Ecology in Migration Studies**

**Katheryn Watson, Gary Ritchison
**Effect of Variation in Nestling Hunger Levels on the Begging Behavior of Nestlings and the Provisioning Behavior of Adult American Kestrels**

*Skyler Wysocki, Jamie L. Wade, Sara M. Pourzamani, Jim Belthoff
**Is Sunbathing by Burrowing Owls a Response to Ectoparasite Infestation?**

**SPECIAL PRESENTATIONS** **Beachcomber**
7:30-8:00 pm B. Clark - Eagle Quest

**SPECIAL PRESENTATIONS** **Driftwood**
7:30-8:00 pm Photography Presentation: N. Dunlop, Megaflocks and Peregrines: Chaos in the Sky
8:00-8:30 pm Photography Presentation: R. Palmer, Burrowing Owls to Bald Eagles: Rob Palmer's Best


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## Friday, September 26

**CONCURRENT GENERAL SESSION V** **Driftwood**
**Threatened, Endangered, and Declining Species | Moderator: Jessi Brown**

| | |
|---|---|
| 8:00 am | (withdrawn) |
| 8:20 am | J. Salgado-Ortiz, Conservation of Strigidae in Mexico |
| 8:40 am | T. Booms, Assessing Conservation of Short-eared Owls |
| 9:00 am | D. Keddy Hector, Review of Aplomado Falcon Conservation |
| 9:20 am | S. Hindmarch, Anticoagulant Rodenticides in Raptors |
| *10:00 am* | *Break* |

**CONCURRENT GENERAL SESSION VI** **Driftwood**
**Threatened, Endangered, and Declining Species (cont.) | Moderator: Rob Bierregaard**

| | |
|---|---|
| 10:20 am | D. Bohra, Poisoning of Gyps Vultures in India |
| 10:40 am | J. Dwyer, Communal Roosting of Crested Caracaras |
| 11:00 am | S. Ahmed, Monitoring and Conserving Egyptian Vultures |
| 11:20 am | J. Gallardo, Extinction Risk for Puerto Rican Sharp-shinneds |
| 11:40 am | J. Morrison, Understanding Transmitter Technology |
| *12:00-1:40 pm* | *Lunch* |

**CONCURRENT GENERAL SESSION VII** **Driftwood**
**Anthropogenic Impacts | Moderator: Carol McIntyre**

| | |
|---|---|
| 1:40 pm | B. Washburn, Eagle-Aircraft Collisions |
| 2:00 pm | L.M. Wang, Retrospective Analysis of Raptor Rehabilitation |
| 2:20 pm | M. Green, Delisting Results for Peregrine Falcons 2003-2012 |
| *2:40 pm* | *Break* |

**CONCURRENT GENERAL SESSION IV** **Beachcomber**
**Andersen Award Session | Moderator: Clint Boal**

| | |
|---|---|
| 8:00 am | A. Huang, Genetics of Barn Owls in North America |
| 8:20 am | K. Linner, Seasonal Raptor Occurrence and Wind Energy |
| 8:40 am | V. Morandini, Floater Interference and Fecundity in Eagles |
| 9:00 am | J. Ng, Agriculture and Energy Impacts on Ferruginous Hawks |
| 9:20 am | J. Wade, Response of Burrowing Owls to Brood Parasitism |
| *10:00-10:20 am* | *Coffee Break* |

SYMPOSIUM **CONCURRENT SESSION II** **Beachcomber**
**American Kestrel Symposium | Moderator: Chris McClure**

| | |
|---|---|
| 10:20 am | C. McClure, Lessons from American Kestrel Nest Boxes |
| 10:40 am | R. Van Buskirk, Land Use and Breeding Success of Kestrels |
| 11:00 am | J. Brown, Temperate vs. Subtropical Nest Survival |
| 11:20 am | J. Smallwood, Researcher-Induced Nest Box Disturbance |
| 11:40 am | J. Klucsarits, Additional Nest Boxes Increase Productivity |
| *12:00-1:40 pm* | *Lunch* |
| 1:40 pm | E. Wommack, Male Behavioral Use of Varied Tail Coloration |
| 2:00 pm | J. Salgado-Ortiz, Sexual Segregation of Habitat in Mexico |
| 2:20 pm | J. Sherburne, Bioavailability of Antimicrobials in Eggs |

| | |
|---|---|
| *2:40-3:00 pm* | *Break* |
| *3:00 pm* | *RRF Business Meeting (closed)* |
| *3:20 pm* | *RRF Business Meeting (open)* |

## Saturday, September 27

**CONCURRENT GENERAL SESSION VIII** — **Driftwood**

**Breeding Ecology | Moderator: Jim Bednarz**

| | |
|---|---|
| 8:00 am | J. Larson, Breeding Ecology of Northern Hawk Owl |
| 8:20 am | J. Bednarz, Reducing Predation in a Canopy-nesting Raptor |
| 8:40 am | B. Clark, Breeding Group Size of Harris's Hawks in Texas |
| 9:00 am | F. Atuo, Spatially Explicit Densities of Prairie Raptors |
| 9:20 am | K. Howard, Habitat selection by Black-shouldered Kites |
| 9:40 am | C. Vennum, Immunocompetence in Swainson's Hawks |
| *10:00 am* | *Break* |

**CONCURRENT GENERAL SESSION IX** — **Driftwood**

**Techniques | Moderator: Brian Washburn**

| | |
|---|---|
| 10:20 am | C. McIntyre, Consistent Use of Terms in Raptor Ecology |
| 10:40 am | M. Tesoro, Chemical Composition of Long-eared Owl Feces |
| 11:00 am | M. Larson, Detection of Short-eared Owls |
| 11:20 am | B. Skipper, Evaluation of Golden Eagle Survey Protocols |
| *12:00-1:40 pm* | *Lunch* |

**SYMPOSIUM CONCURRENT SESSION III** — **Driftwood**

**Coastal Raptors Symposium | Moderator: Dan Varland**

| | |
|---|---|
| 8:00 am | D. Varland, Coastal Raptors |
| 8:20 am | P. Sharpe, Restoration of Bald Eagles on Channel Islands |
| 8:40 am | B. Mutch, Restoring Aplomado Falcons to the United States |
| 9:00 am | M. Yates, Long-term Studies of Migrating Peregrine Falcons |
| 9:20 am | T. Maechtle, Peregrine Falcons Accumulate Hydrocarbons |
| 9:40 am | S. Lewis, Peregrine Falcon Subspecies on the Gulf of Alaska |
| *10:00-10:20 am* | *Break* |
| 10:20 am | W. Nelson, Nestling Weights in Peregrines and Vultures |
| 10:40 am | A. Franke, Breeding Ecology of Nunavut Peregrine Falcons |
| 11:00 am | S. Heinänen, Modeling Flight of Raptors Crossing Water |
| 11:20 am | K. Meyer, Use of Peripheral Wetlands by Snail Kites |
| 11:40 am | J. Gallardo, Foraging by Snail Kites in Veracruz, Mexico |
| 12:00-1:40 pm | Lunch |
| 1:40 pm | R. Bierregaard, Ospreys and Humans in New England |
| 2:00 pm | B. Drahota, Abundance and Habitat of Virginia Bald Eagles |
| *2:20-2:40 pm* | *Break* |

| | |
|---|---|
| **2:40-3:40 pm** | **Keynote: A Lifetime of Migration, Steve Hoffman** |
| **6:30 pm** | **Banquet Dinner** |

# General Session Abstracts

**Monitoring and Conservation of the Egyptian Vulture (Neophron percnopterus) in the United Arab Emirates**

*SHAKEEL AHMED (akhan@ead.ae), SHAHID.B.KHAN, JUNID.N.SHAH, SÁLIM JAVED, Environment Agency – Abu Dhabi, Abu Dhabi Emirate, United Arab Emirates

The globally threatened Egyptian Vulture (Neophron percnopterus) is a widespread resident as well as a migrant and winter visitor to Arabia. In the UAE not much is known about the species which is largely restricted to the Jebel Hafeet Mountain (24°5'37"N 55°45'50"E) in Abu Dhabi Emirate. We undertook routine monitoring of the species at three localities from 2008 to 2013 and a total of 110 monitoring were conducted to count the foraging and roosting birds. The number of individuals recorded per monitoring was 4 ± 1 (Mean ± SE). The number of birds did not vary significantly across the months ($F = 1.56$, $df = 11$, $p = 0.12$, Oneway ANOVA). However, highly significant difference was recorded across the years ($F= 3.58$, $df = 5$, $p = 0.00$, Oneway ANOVA). Furthermore, number of individuals were recorded more in winter than summer season and the difference was not statistically significant ($F = 0.95$, $df = 1$, $p = 0.33$). The highest numbers of 62 individuals of different age groups were sighted in November 2013 which is the highest record in six years. Their numbers seems to have declined recently compared to old records of 50-100 birds regularly reported from the mountain. As the species is globally threatened, a programme to understand movement and migration pattern using satellite telemetry is being initiated in combination with food provisioning, largely to attract birds to the provisioned food for capture and tagging. It is expected that this will result in discovery of the potential nesting sites of the species on Jebel Hafeet and would possibly help the conservation of this unique mountain habitat and its nationally and internationally important flora and fauna, such as the Egyptian Vulture.

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**Modeling Spatially Explicit Densities of Multiple Raptors in Mixed-grass Prairie Landscapes**

*FIDELIS ATUO (fidelis.atuo@okstate.edu), and T. J. O'CONNELL, Oklahoma State University, Stillwater, OK, U.S.A.

The North American Great Plains supports multiple species of diurnal raptors that potentially rely on similar sources of food (e.g., small mammals) and nesting substrates (e.g., isolated large trees). At broad scales, these species co-occur. In this study, we sought to determine the scales at which multiple raptor species partition habitat in mixed-grass prairie landscapes. From December 2012 through April 2014, we conducted monthly surveys of raptors at two state wildlife management areas separated by approximately 100 km in western Oklahoma. Using distance sampling on line transects, we recorded 1,421 sightings of 15 diurnal and 2 nocturnal species and estimated spatially explicit habitat use for all raptors. Overall, mixed grasses, relatively sparse ground cover, and more abundant canopy trees were important vegetation variables in predicting raptor abundance with broad overlap among species. Red-tailed Hawks (Buteo jamaicensis) were the most abundant raptor at both sites (0.046/ha annual density), both as a breeding species and when reaching the species' highest densities during autumn and winter. Habitat use by Red-tailed Hawks overlapped broadly with that of Swainson's Hawks (Buteo swainsoni) during breeding seasons and Northern Harriers (Circus cyaneus) during wintering seasons. However, fine-scale habitat use indicated greater reliance on riparian trees for Red-tailed Hawks. Our analysis provides evidence for fine-scale niche partitioning among the most abundant raptors on our study sites.

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**Ospreys (Pandion haliaetus) and Humans along the Coasts of Southern New England–Inextricably Entwined Species**

*RICHARD O. BIERREGAARD (rbierreg@gmail.com), Academy of Natural Sciences of Drexel University, Philadelphia, PA, U.S.A.

Ospreys have long been a conspicuous and iconic species along the coasts of southern New England and Long Island, NY. The Ospreys nesting on 13.4 km2 Gardiners Island on the east end of Long Island formed the densest colony of the species ever known. In 1812, in his seminal American Ornithology Alexander Wilson mentions 300 pairs in a colony on Gardiners Island, and the colony maintained those numbers until the dichlorodiphenyltrichloroethane (DDT) era. The precipitous decline of this colony, the famous population in the Connecticut River estuary, and the more dispersed population on adjacent eastern Long Island was instrumental in focusing attention on DDT as a causal agent in the decline of avian predators atop long food chains. Since the ban on DDT initiated in the late 1960s and early 1970s, the southern New England population has rebounded from approximately just over 100 pairs


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to at least 1,300 pairs, exceeding the estimated pre-DDT Osprey population. The post-DDT population is highly dependent on human-made structures for nesting. In 2010 only 5% of known Osprey nests were in trees, with the rest predominantly on nest platforms. Population growth in the species continues to be strong in parts of the region. The habit of nesting on human-made structures often puts Ospreys at risk and makes the species one that demands more active management than any other non-threatened raptor species.

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**Diclofenac Poising of Avian Scavengers at Jorbeer, India**

*DAU LAL BOHRA (daulalbohara@yahoo.com), and SRADHA VYAS, Save Vulture Community, Bikaner, Rajasthan, India.

Diclofenac, a nonsteroidal anti-inflammatory drug effective in mammals, is poisonous to birds and is widely recognized as the primary driving force behind the rapid decline of avian scavengers in India. Locally available diclofenac formulations are intended for human use, but are often redirected for use in cattle. When treated cattle die, secondary poisoning of avian scavengers becomes possible. Our study describes a population of wintering raptors near the rural village of Jorbeer in Rajasthan, India, where a regional disposal location for cattle carcasses exists. In 2012–2013 we found 127 dead birds at Jorbeer, including 22 Eurasian Griffon Vultures (Gyps fulvus), 55 Steppe Eagles (Aquila nipalensis), 42 Egyptian Vultures (Neophron percnopterus), and 8 Black Kites (Milvus migrans). In 2013–2014, we found 145 dead birds, including 25 Eurasian Griffon Vultures, 65 Steppe Eagles, 52 Egyptian Vultures, and 13 Black Kites. Only a small proportion (< 0.8%) of ungulate carcasses containing lethal levels of diclofenac is sufficient to cause the rapid population declines observed in India. The mortality we documented is a small sample representative of a problem occurring widely throughout India. Consequently, we strongly recommended complete withdrawal of Diclofenac from the market.

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**Assessing the Status and Conservation Priorities of the Short-eared Owl in North America**

*TRAVIS L. BOOMS (travis.booms@alaska.gov), Alaska Department of Fish and Game, Fairbanks, AK, U.S.A. GEOFFREY L. HOLROYD, Environment Canada (retired), Edmonton, AB, Canada. MARCEL A. GAHBAUER, Migration Research Foundation, Ste-Anne-de-Bellevue, QC, Canada. HELEN E. TREFRY, Canadian Wildlife Service (retired), Edmonton, AB, Canada. DAVID WIGGINS, Hallkved, Uppsala, Sweden. DENVER W. HOLT, Owl Research Institute, Charlo, MT, U.S.A. JAMES A. JOHNSON, U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, AK, U.S.A. STEPHEN B. LEWIS, U.S. Fish and Wildlife Service, Migratory Bird Management, Juneau, AK, U.S.A. MATT D. LARSON, Owl Research Institute, Charlo, MT, U.S.A. KRISTEN L. KEYES, Migration Research Foundation, Ste-Anne-de-Bellevue, QC, Canada. SCOTT SWENGEL, Baraboo, WI, U.S.A.

The North American Breeding Bird Survey, Christmas Bird Count, and regional and national conservation assessments provide convincing evidence that the Short-eared Owl (Asio flammeus) is experiencing a range-wide, long-term decline in abundance in North America. However, the species has received little conservation or research attention. The Short-eared Owl is vulnerable to decline because it relies heavily on large, intact grasslands and a specialized diet of unpredictable small mammal prey. The species' nomadic movements compound these vulnerabilities by making a decline difficult to detect with current monitoring programs while obfuscating stewardship responsibilities for managers. The primary threat to the species is loss, fragmentation, and degradation of large tracts of native grasslands and wetlands. We propose the following conservation priorities to better understand and begin addressing the Short-eared Owl's decline: 1) Better define and protect important habitats; 2) Improve population monitoring; 3) Determine seasonal and annual movements; 4) Re-evaluate NatureServe's Short-eared Owl national conservation classifications; 5) Develop management plans and tools; and 6) Classify raptors, including Short-eared Owls, as migratory birds in Canada. We contend that the Short-eared Owl's need for habitat conservation at large spatial scales, status as a predator, and high reproductive potential that affords the species capacity to recover, make it an effective and useful candidate as an umbrella species for grassland conservation.

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**Correlates of Variability in Monthly Home Range of Mojave Golden Eagles (Aquila chrysaetos): Interpreting the Scale of Threat from Renewable Energy**

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Renewable energy has the potential to impact Golden Eagles at all stages of their life history. To understand the degree to which eagle populations may be impacted by renewable energy development, we must understand space use by eagles. That knowledge will allow wildlife managers to determine which wind turbines or solar arrays likely present risks to which eagles. To explore this, we studied year-round movements of Golden Eagles (n = 8) with GPS-GSM telemetry systems between January 2012 and December 2013 in California's Mojave Desert. Monthly home range (95% adaptive localized convex hull or LoCoHa) of eagles averaged 307.7 ± 66.4 km2 (± SE). Monthly core areas (50% LoCoHa) used by eagles averaged 16.0 ± 5.0 km2, but ranged from 0.10 to 484.1 km2. Mean size of home ranges was smallest and least variable from November through January (mean = 47.2 ± 7.6 km2; range = 9.0–177.9 km2) and largest in March (751.2 ± 475.9 km2, range = 4.5–3440.1km2). In addition to monthly variations, we recorded significant inter-annual variation in home range size ($F_{0.5, 2, 92} = 9.96$; $P = 0.0001$). In 2012, when all eagles bred, home range size between February and April averaged 32.1 ± 7.0 km2. In 2013, when no eagles bred, home range size during those same months averaged 820.0 ± 318.3 km2. Movement of Golden Eagles was positively tied to the range of elevation ($F_{0.5, 1, 92} = 87.04$; $P < 0.0001$) and the proportion of gentle slopes ($F_{0.5, 1, 92} = 5.01$; $P = 0.028$) within home ranges. Because most of the eagles that we studied ranged over very broad areas during specific times of the year, renewable energy facilities that kill eagles may draw from a large proportion of the regional population.

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**The Raptor Population Index–2013 Summary of Results**

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The Raptor Population Index (RPI) partnership consisting of the Hawk Migration Association of North America, Hawk Mountain Sanctuary, and HawkWatch International was formed in 2003, with the goal of using migration count data to assess trends in North American raptor populations. Through the RPI project, hawk-watching has become a major citizen-science effort contributing to raptor conservation. RPI used historical data collected through 2004 to produce the 2008 State of North America's Birds of Prey, which summarized trends in count data from 21 migration watch sites. Since then RPI added Bird Studies Canada as a fourth partner, and has focused its efforts on developing a web-based analysis system for regular trend updating using hourly migration count data entered into HawkCount.org. This paper highlights the results of the 2013 update including over 60 count sites, and available on-line at rpi-project.org. Results are synthesized regionally in combination with concurrent Breeding Bird Survey and Christmas Bird Count data. Although there is geographical variation, the results suggest that the following species are increasing: Turkey Vulture (Cathartes aura), Black Vulture (Coragyps atratus), Bald Eagle (Haliaeetus leucocephalus), Mississippi Kite (Ictinia mississippiensis), and Peregrine Falcon (Falco peregrinus). Species that appear to be declining include: American Kestrel (Falco sparverius), Northern Harrier (Circus cyaneus), Northern Goshawk (Accipiter gentilis), and in the west, Golden Eagle (Aquila chrysaetos). A few species such as Cooper's Hawk (Accipiter cooperii), Merlin (Falco columbarius) and the eastern population of Golden Eagle experienced long-term increases since the 1970s, but no longer appear to be increasing.

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**Annotation of Raptor Telemetry Tracks with Orographic and Thermal Lift Velocities Using Movebank Env–DATA**

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Telemetry is the tool of choice for research on raptor movements, but analysis techniques and tools for understanding movement data in the context of the dynamic and heterogeneous atmospheric and terrestrial environments are not keeping up with our ability to collect telemetry data. The Movebank Env-DATA system is a useful and evolving tool that will assist raptor biologists in developing a mechanistic understanding of their telemetry tracks. For many raptor species, movement is dependent on atmospheric sources of lift, such as convective thermals and orographic lift generated by upward deflection of surface winds. These and other lift mechanisms support local movements underpinning continental-scale migration. In the case of some raptor species, soaring flight using low-altitude orographic lift is correlated with elevated collision risk at wind farms. Thus, the ability to model orographic lift may be valuable in understanding collision risk. The Env-DATA system incorporates models for estimating orographic and thermal uplift velocity along movement tracks based on digital elevation data and archived weather data interpolated to the location and time of each telemetry datapoint. This paper will use two contrasting examples of segments of high-resolution GSM migration tracks of Golden Eagles (Aquila chrysaetos) in eastern North America to illustrate how researchers with telemetry data can run these models in Env-DATA. The examples clearly demonstrate that Golden Eagles use thermal lift and orographic lift during migration as a function of weather conditions and terrain.

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**Different Patterns of Nest Survival in American Kestrels Breeding in Temperate and Subtropical Latitudes**

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The American Kestrel (Falco sparverius) breeds across a broad latitudinal gradient in the western hemisphere, from high latitudes in temperate environments through subtropical and tropical regions. We hypothesized that kestrel populations in diverse latitudes would also vary in important demographic and life history parameters, such as patterns of nest survival. We compared temporal patterns of nest survival of partially migratory kestrels using nest boxes near Boise, Idaho (F. s. sparverius) to year-round resident kestrels in subtropical north-central Florida (F. s. paulus) with Bayesian nest survival mixed models. Nests were monitored during two time periods by two different investigators in Idaho (1992–2005, 719 nests in 115 boxes; and 2008–2012, 199 nests in 88 boxes), and from 2008–2010 in Florida (313 nests in 125 boxes). Patterns in nest survival differed between the Idaho and Florida nests. In Florida, nest survival varied between years with markedly higher nest success in 2010. Nest survival peaked very early in the season. Within a single breeding attempt, nest survival was lowest during the middle of the attempt. In Idaho, nest survival was highest during moderate nest ages, though nest survival was highest in the early middle of the nesting season, as it was in Florida. Highest overall success occurred 1998–2005, and lowest from 1994–1996. We hypothesize that seasonal and annual variations in prey availability may drive nest survival in Florida, whereas the dominant effect in Idaho may be arrival time from wintering grounds or the choice to overwinter locally.

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**Land Use as a Predictor of Breeding Success for American Kestrels (Falco sparverius) in the Willamette Valley of Oregon**

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Data from sources such as the Breeding Bird Survey, Christmas Bird Counts, nestbox monitoring programs and migration counts suggest that American Kestrel populations are in decline across a significant portion of North America. Some hypothesized causes include exposure to second-generation rodenticides, increases in predator populations, and habitat fragmentation and alteration on a landscape level. This project investigates the effect of habitat type on breeding success by examining the relationship between land use surrounding kestrel nesting sites and the number of offspring produced. Working with natural and artificial nest sites located in rural and exurban regions of Washington County, Oregon, we monitored the breeding success of several kestrel pairs. We also characterized land use types in the core territory immediately adjacent to each nesting location. We estimated core territory size from telemetry data collected on a subset of the individuals followed. Using ArcGIS, we determined the percentage of each habitat type within a standard core territory surrounding each nesting location. We used the number of nestlings produced (approximately 10–20 days old) as a

measure of reproductive success and regressed this against the percentage of each landscape type adjacent to each nesting location. Our results indicate that low percentages of several land use types are negatively associated with nesting success. By learning more about the relationship between land use mosaics and reproductive success, we might be better able to predict the impact of landscape-level changes in land use on kestrel numbers.

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**Gap Analysis and Conservation Recommendations for Strigidae in the State of Michoacán, México**

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Owls are one of the least studied groups in México. Information on life history traits is largely anecdotal and systematic studies on demography are so scarce that conservation status for many species is either unknown or weakly supported by available information. In this study we conducted a gap analysis to determine the efficiency of natural protected areas for conservation of owl diversity in the state of Michoacán, México. We used historical records obtained from international and national databases, and we used MAXENT software and Euclidian distance method to model the distribution of owls, considering individual and total species richness. To determine owl conservation needs, we used a 10% representation criterion for each species within the protected area system as a threshold to be considered as having an adequate conservation status. We modeled the distribution of 15 owl species, but none achieved the 10% conservation criteria. Best represented species included Mottled Owl (Ciccaba virgate) with 8% followed by Ferruginous Pygmy Owl (Glaucidium brasilianum) with 6%. Both endemic and endangered species were poorly represented within protected areas. Regions with the highest species richness corresponded to the Neovolcanic ridge system, but even these areas were poorly represented within the existing protected areas network. It is urgent to discuss and promote new conservation strategies such as that of Important Bird Areas or indigenous land conservation initiatives to ensure long term conservation of owls in Mexico.

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**Insights into the Phylogeny of Diurnal Raptors from their Feather Lice**

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Most bird species host feather lice, which are permanent parasites, spending their entire lifecycle on the host. While many lice are incredibly host specific, others, including those found on diurnal birds of prey are less so. Although they lack strong host specificity, these lice can provide insight into higher level relationships in diurnal raptors. Additionally, the presence of multiple genera of lice occurring on the same hosts enables independent tests of inferred relationships. We collected lice of two genera, Degeeriella and Colpocephalum, from diurnal birds of prey worldwide. Degeeriella are limited to Accipitridae and Falconidae and were collected from 14 host genera. Colpocephalum occur on multiple orders of birds, and represented here by lice collected from all 5 families of diurnal birds of prey (15 host genera) along with various owl and non-raptor hosts. We sequenced multiple genes (1 mitochondrial and 3 nuclear for Degeeriella and 1 mitochondrial and 1 nuclear for Colpocephalum) and included each genus in phylogenetic datasets spanning related louse genera. Phylogenetic analyses revealed that Degeeriella is polyphyletic, with falcon lice forming a clade sister to a genus of woodpecker louse, while lice from rollers were nested within lice from Accipitridae. Patterns were more complex in Colpocephalum, with multiple switches between diurnal birds of prey and non-raptors. Interestingly, phylogenies of both Degeeriella and Colpocephalum suggest lice moved from raptors to non-raptors rather than from non-raptors onto raptors. While lice relationships follow host relationships at some levels, geography plays a role at fine scales. For example, lice from Red-tailed Hawks in the western United States were found to be more closely related to Rough-legged Hawk lice from the same region than to lice from Red-tailed Hawks east of the Mississippi River.

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**Preferred Nest Site Characteristics Reduce Predator-**

**specific Predation Risk in a Canopy Nesting Raptor**

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Habitat features influence nest survival and, as a result, identifying relationships between habitat characteristics and nest survival remains a central focus among studies of avian reproductive success. In cases where nest predation is the main cause of failure, knowing how the habitat affects predation risk may provide managers with a tangible means by which to improve reproductive rates. The Mississippi Kite (Ictinia mississippiensis) is a species of regional conservation concern due to small population sizes and low rates of reproductive success. We monitored Mississippi Kite nests, used video cameras to document causes of nest failure, and examined relationships between habitat features and predator-specific patterns in nest predation in a floodplain forest in east-central Arkansas. We identified Texas ratsnakes (Pantherophis obsoletus) and owls (Strigidae) as the dominant nest predators. Predation by each was influenced by different habitat features. Texas ratsnake predation was greater in areas with fewer overstory trees and when kite nests were positioned farther above the tree canopy. Owls were more likely to depredate nests farther from the forest edge and nests that had less canopy coverage around them. Our results illustrate that nest site characteristics preferred by kites reduce nest predation risk, indicating most of the management actions proposed to promote kite nesting are likely to create or maintain quality habitat for this species in the Mississippi Alluvial Valley. Beyond knowing the main causes of nest failure in kites, our results also provide a glimpse into threats faced by mid-story and other canopy-nesting birds, a guild for which very little information exists regarding causes of nesting failure.

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**Harlan's Hawk, a Subspecies of Red-tailed Hawk? Or Not?**

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Harlan's Hawks were first described by Audubon as Buteo harlani, based on a specimen he collected in Louisiana in 1830. The specimen, now in the British Museum, was a dark-morph adult and had a gray tail. This taxon has three times been deemed by the American Ornithological Union (AOU) check-list Committee to be a subspecies of Red-tailed Hawk (Buteo jamaicensis). In 1892 and 1972 this designation was made without taxonomic justification. In 1944 references were used to justify the decision. I will discuss these taxonomic decisions, and explain what I have learned about this interesting raptor in years of field and museum study. Specifically, I will demonstrate that Harlan's Hawks differ consistently from Red-tailed Hawks in five characteristics and that light-morph adult Harlan's Hawks are interbreeding with Red-tailed Hawks over a large area of western Canada. As Red-tailed Hawks have interbred with four other Buteo species, this interbreeding in itself does not imply that Harlan's Hawk is a subspecies. I will briefly discuss several papers used to support Harlan's Hawk being a Red-tailed Hawk subspecies and why their justifications are not convincing. I will present a possible scenario for the evolution of Harlan's Hawk from Red-tailed Hawk. Finally, I will demonstrate that the criteria for assigning species rank used by the British Ornithological Union supports Harlan's Hawk being a species. The AOU lacks such criteria.

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**Sizes of Breeding Groups of Harris's Hawk in Southern Texas**

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The only previous study of breeding Harris's Hawks (Parabuteo unicinctus) in Texas published in a peer-reviewed journal reported that only one of 19 breeding groups consisted of more than two adults. It was conducted in west Texas and did not discuss or consider nest helpers. Other studies of this species in Texas, as reported in Ph.D. Dissertations, found a few instances of extra adults and one case of a nest helper. In eleven years of banding, I have found that many groups of this species in south Texas included three to seven individuals. I regularly capture two adults of the same sex or three or four Harris's Hawks together, sometimes including more than two adults, at the same time and location. Harris's Hawks can breed in any month in south Texas. This year I located and regularly visited the nest areas of many groups of Harris's Hawks in the lower Rio Grande Valley of Texas, and recorded the maximum number of individuals involved in each breeding group. By making more and longer nest observations and by capturing, banding, and observing multiple adults and helpers in breeding areas, especially when feeding

fledglings, I found that more than two individuals occurred in many groups of nesting Harris's Hawks in south Texas. They nest in a variety of tree species and man-made structures and in urban, suburban, and forested areas. As reported in an Arizona study, fewer and shorter nest visits and not looking for nest helpers result in underestimating the size of Harris's Hawk breeding groups. This is the most likely reason that earlier studies in Texas recorded few breeding groups larger than a pair.

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**White Sands Missile Range–Avian Protection Plan: Power Line Bird Protection in Support of the Military Mission**

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White Sands Missile Range (WSMR) is the largest U.S. overland military installation, encompassing portions of five New Mexico counties and three rural electric power service areas. The WSMR electric power grid is extensive and complex with hundreds of kilometers of distribution power lines with varying configurations. WSMR initiated a facility-wide Avian Protection Plan (APP) in 2012 to reduce bird electrocution risk and animal-caused outages, ensuring regulatory compliance with the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act. EDM International, Inc. (EDM) prepared the APP which included an avian field Risk Assessment (RA). WSMR's historic approach has been to retrofit hazardous poles and transformer banks and de-energize unused electric lines in raptor habitat. This approach can allow at-risk configurations to persist unrecognized when lines are re-energized for new missions. EDM surveyed 80% of the power line grid in 2012, resulting in over 1,000 structures and areas with retrofitting recommendations. We assigned each RA recommendation a risk prioritization ranking (1–4) based on factors including habitat, bird use, and power line configuration. The final deliverable included a matrix specifying what was needed at each pole to make it avian friendly. Poles with equipment and exposed jumpers and antiquated ground banks were highly associated with detected avian incidents and received the highest RA priority ranking of 1. Retrofitting challenges included developing strategies to mitigate remote three-phase metal switch structures with prominent Golden Eagle (Aquila chrysaetos) presence, while balancing high levels of raptor use within the more populated Main Post. The APP was approved in 2014 and provides a short- and long-term planning tool to mitigate high-risk poles, making the power system more reliable and thus supporting military mission readiness.

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**Abundance and Habitat Associations of Bald Eagles (Haliaeetus leucocephalus) in the Chesapeake Bay, Virginia**

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In eastern North America, most Bald Eagle populations were recently historically low but today have increased by an order of magnitude. To manage the extremely high numbers of Bald Eagles present in some regions, it is essential to understand their age-specific distribution in the context of the natural and anthropogenic landscape features they encounter. We surveyed Bald Eagles by boat along the length of rivers feeding into the Chesapeake Bay, Virginia. We recorded Bald Eagle locations, ages, and behavior, and linked these records to river sections and habitat features within a GIS. We used occupancy models to analyze our data. Preliminary results for the winter season suggest that probability of detection of eagles differed by age class, ranging from 0.48 to 0.88. All ages occupied each river stretch (occupancy rates = 1.00). During the summer season, detection probabilities ranged from 0.67 to 1.00, with values near one for sub-adult birds in some months. The model with the greatest support for summer had high likelihoods of occupation for each age class and river section (occupancy rates = 1.00). Human recreational activity had little effect on occupancy by adult Bald Eagles, but sub-adults had lower occupancy rates when humans were present. Age-related differences in detection and occupancy rates suggest the behavior of Bald Eagles differs among age classes. Such age-specific behavior may have important implications for management.

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**Concurrent Communal Roosting of Crested Caracaras, Black Vultures, Turkey Vultures, and Wading Birds at a Single Roost in Florida**

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Many raptors use communal roosts during migration, wintering, or non-breeding dispersal. Wading birds also use communal roosts during these periods and during breeding seasons. Numerous studies have investigated communal roosting by individual species or related species groups, but concurrent use of communal roosts by raptors and wading birds has not been investigated. From 9 August 2006 through 17 April 2009 we counted non-breeding Crested Caracaras (Caracara cheriway), and Black Vultures (Coragyps atratus), Turkey Vultures (Cathartes aura), Cattle Egrets (Bubulcus ibis), Great Egrets (Ardea alba), White Ibis (Eudocimus albus), and numerous other species using a communal roost near MacArthur Agro-ecology Research Center near the center of the Crested Caracara's range in Florida, U.S.A. We conducted 407 counts of birds entering the roost in evenings, and 63 counts of birds departing the roost in mornings. We observed Crested Caracaras and at least one of the two vulture species during every count. We observed wading birds during most counts. More non-breeding Crested Caracaras, and more Turkey Vultures and wading birds used the roost during these species' non-breeding seasons. Black Vultures used the roost relatively consistently year-round, but in much smaller numbers. Crested Caracaras departed the roost earlier than vultures, perhaps minimizing competition for carrion. Avian conservation typically focuses on nest sites, but communal roosts can be critical to species' persistence. Resource managers in Florida should expand conservation and management for birds in general, and for Crested Caracaras in particular, to include protection of communal roosts.

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**Breeding Ecology of Peregrine Falcons in Nunavut, Canada**

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The historical decline of Peregrine Falcons (Falco peregrinus) in North America during the mid-twentieth century was mainly attributed to reproductive failure associated with persistent organic pollutants. It is in this context that the "Arctic Raptor Project" was initiated in 1982 to study the breeding ecology of Peregrine Falcons (F. p. tundrius) nesting in the Arctic. Here we present a summary of a research program carried out mainly in the Rankin Inlet area, and near Igloolik and Baffin Island in Nunavut. Results from research on the diet, reproductive phenology, growth and survival of young, and effects of environmental variables on population dynamics will be presented. Long-term monitoring has resulted in documentation of a decrease in the number of young produced in recent years. Changes in the regime of summer rainfall seem to be partly responsible for these declines. Improving our knowledge of the ecology of raptors nesting in the Arctic is a major challenge to understanding their vulnerability to global change.

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**Migration Phenology of Peregrine Falcons wearing Satellite Transmitters and Geolocators**

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Migration phenology and behavior is an important component of the life history of many species of raptors. Here we report our findings on some aspects of migration phenology of highly migratory Peregrine Falcons (Falco peregrinus) wearing 22 g Platform Terminal Transmitters (PTTs) fitted to individuals using backpack attachments, compared to phenology of Peregrine Falcons wearing 1 g light sensitive geolocators (GLs). In general, it appears that migration duration of Peregrines wearing PTTs is significantly longer than those wearing GLs. Specifically, departure dates appear to be similar, but arrival dates at wintering areas are much later (approximately 25 days). Notwithstanding the value of data accumulated using PTTs, these findings illustrate the importance of understanding potential effects of researcher's choice of tracking device in migration studies.

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**Foraging Behavior and Hunting Success of Snail Kite (Rostrhamus sociabilis major) in Catemaco Lake, Veracruz, Mexico**

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Snail Kites are gregarious raptors that use two foraging strategies, perch hunting and flight hunting, to feed almost exclusively on Pomacea snails. We observed 432 hunting attempts on endemic snails (Pomacea patula catemacensis) during 2007 and 2008. Contrary to previous studies, flight hunting was the predominant hunting method in wet and dry seasons, representing 84% of observations ($z = 19.98$, $P < 0.001$). Success was 85% from perches and 46% in flight ($z = 5.90$, $P < 0.001$). Juveniles hunted more often from perches than adults ($z = 7.61$, $P < 0.001$). Mean success was 53 ± 5%, where juveniles showed 63% and adults 46% ($z = 3.46$, $P < 0.001$). Success was 68% during the wet season and 47% in the dry season ($z = 3.89$, $P < 0.001$). Both adults and juveniles had greater success during the wet season (adult: 71%, $z = 1.93$, $P = 0.027$; juveniles: 68%, $z = 1.79$, $P = 0.037$). Flight hunting durations ranged from 7 sec to 7.98 min. Success was negatively related to time invested. Mean time invested was 1.34 min in wet seasons and 3.29 min in dry seasons ($t = -5.59$, $P < 0.001$). Adults invested more time than juveniles, with a mean of 4.33 minutes and 1.97 minutes respectively ($t = 5.56$, $P < 0.001$). Number of individuals and hunting success showed a tendency towards an inverse linear relationship ($t = 3.94$, $P = 0.0001$). Hunting success in our study site is lower than previously reported (> 80%), and low for a raptor specializing on invertebrates (> 76%). In our study site, Pomacea snails are one of the most important commercial fisheries products, but were undergoing population collapse. Population fluctuations of the Snail Kite's main prey may dictate the hunting behavior of this food specialist.

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**The Puerto Rican Sharp-shinned Hawk (Accipiter striatus vennator): An Insular Species on the Edge of Extinction**

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The Sharp-shinned Hawk is a continental forest raptor with several Neotropical breeding populations, including three endemic subspecies in the Caribbean. The Puerto Rican Sharp-shinned Hawk (hereafter PR Sharp-shinned) is an endangered woodland raptor inhabiting mature and old second growth montane forests and coffee plantations. PR Sharp-shinneds have small clutches, reduced dispersal, and low productivity, and declined 40% from 1986 to 1991. The 1991 survey indicated only 82 individuals in five montane reserves. We set out to identify current PR Sharp-shinned population estimates and important habitat characteristics in Maricao Forest, the area with the largest known historical population of PR Sharp-shinneds (previously 60–70 individuals). During the breeding season of 2013 (January–April), we invested 636 hours using playback, display searches from overlooks, and ground searches in historical PR Sharp-shinned territories. We recorded only seven sightings including two active breeding territories. During the breeding season of 2014, the number of breeding territories remained the same, but the specific areas changed. Also in 2014, we extended our searches into six additional montane reserves and into private lands, but located only five additional active nesting territories and a single adult male. Our preliminary results suggest a significant ongoing population decline in Maricao Forest, and an isolated distribution of remaining breeding territories along the Cordillera Central. This decline may be a result of a series of external factors, including post-hurricane habitat modification, forest fragmentation, high rates of nestling mortality due to botfly parasitism (Philornis species), and intrinsic demography limitations arising from adaptations to insular oceanic environments. The future of PR Sharp-shinneds is uncertain despite legal protection, including an approved recovery plan since 1997, because no conservation efforts have been implemented.

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**Negative impacts of 15 kV Power Lines on the Birds of Mongolia**

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Wood and concrete poles supporting power lines are attractive perching substrates for raptors in Mongolia where natural elevated perches are scarce. The configurations of these structures place energized wires in immediate proximity to paths to ground, leading to substantial avian electrocution risks. The main aims of our study were to determine negative impacts of a 15 kilovolt (kV) line to birds on the steppe during the breeding and migration periods, to clarify the reasons for electrocution and collision, and to design and implement bird-friendly retrofitting measures to reduce electrocution risk. We conducted field research in September 2007, September 2008, and June and September 2009. We found 529 avian carcasses of 29 species, resulting from electrocution or collision. Among electrocuted birds, 207 (64%) were raptors and 116 (36%) were non-raptors. All electrocuted raptor species found are listed in the appendices of international conventions, such as Convention on the Conservation of Migratory Species and the Convention on International Trade in Endangered Species. For example, according to the International Union for Conservation of Nature, Red List categories, three of the species we found electrocuted, Lesser Kestrel (Falco naumanni), Cinereous Vulture (Aegypius monachus), and Saker Falcon (Falco cherrug), are vulnerable, near threatened, and endangered, respectively. Our study examined only 283 km of lines. Extrapolation across Mongolia's 2,414 km of lines suggests the annual average number of electrocuted birds is 783. Urgent action to insulate metal cross-arms and energized wires is necessary to conserve Mongolia's raptors.

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**Delisting Monitoring Results for the American Peregrine Falcon (Falco peregrinus anatum), 2003-2012**

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The American Peregrine Falcon was removed from the list of threatened and endangered species (delisted) by the U.S. Fish and Wildlife Service (USFWS) in 1999 because population goals had been met in each recovery region. In 2003, the USFWS, in cooperation with stakeholders, completed writing a monitoring plan for the American Peregrine Falcon. This plan described the objectives and methods for post-delisting monitoring of the species, as required by the Endangered Species Act (ESA). Every three years, from 2003 through 2012, the USFWS has organized and coordinated post-delisting monitoring of the American Peregrine Falcon across the United States. We provide a summary of the results from 2003 through 2012 for this post-delisting monitoring effort. Our results highlight post-delisting estimates of territory occupancy, nest success, and productivity (and their 90% credible intervals) across six regions and nationally. These measures demonstrate that American Peregrine Falcons are continuing to do well overall.

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**Estimation of Relative Abundance and Determination of Sexual Segregation by Habitat of Overwintering American Kestrels (Falco sparverius) within Agricultural Landscapes in Central Mexico**

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The American Kestrel (Falco sparverius) has undergone significant population declines in the U.S.A. and Canada, but the reasons for this decline are not well understood. In México, where American Kestrels include resident and migrant populations, no systematic studies have been conducted to determine abundance or whether populations are stable or declining. Consequently, the conservation status of the American Kestrel in México remains poorly documented. We conducted surveys for American Kestrels along secondary roads within two types of agricultural systems (irrigated cropland and dryland-livestock farming), and one type of native habitat (subtropical shrubland) in the northern portion of the state of Michoacan in Central Mexico where American Kestrels overwinter. Our goal was to determine relative abundance and habitat segregation

by sex in this portion of the range. From August 2013 to April 2014, we conducted a total of 22 surveys ranging from 10 to 25 km. We recorded American Kestrels from mid-October through early April. We accumulated a total of 411 sightings, of which 69% were females and 23% males. The average number of individuals recorded per route was 18.7 per 20 km. We found habitat segregation by sex, with irrigation and dryland-livestock farming significantly female biased and subtropical shrubland male biased. This is the first study documenting relative abundance and habitat segregation by sex in overwintering areas in México. Although our results are preliminary, our data suggest that the American Kestrel population wintering in this area is apparently in good conservation status.

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**Endangered Ridgway's Hawk (Buteo ridgwayi) Electrocutions**

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Ridgway's Hawk is an endangered raptor with only 182-218 adults endemic to Hispaniola. To supplement the population, The Peregrine Fund initiated a Ridgway's Hawk population enhancement program. From 2009 through 2012 The Peregrine Fund released 19 birds in Punta Cana, Dominican Republic. Ridgway's Hawks readily perch on anthropogenic structures, including as power poles, and 3 (27%) of 11 birds released in 2011 and 2012 were electrocuted. The electrocutions resulted in suspension of the population enhancement program and initiation of a power line retrofitting program. In 2013, approximately 50 poles in high quality habitat near the Punta Cana release site were fitted with elevated perches. After retrofitting, in 2014 the population enhancement program was reinitiated and by July an additional 29 hawks were released. Unfortunately, six birds were electrocuted; four on poles fitted with elevated perches. In response EDM International, Inc. (EDM), a company specializing in raptor protection strategies, was asked to review the program and make recommendations. We visited Punta Cana in July 2014, and with The Peregrine Fund, conducted a detailed analysis of 101 distribution 7.2/12.47 kilovolt (kV) power poles surrounding the release site. The use of concrete poles and metal crossarms in this area provide inadequate electrical separation, and we found birds as small as an American kestrel (Falco sparverius) electrocuted. Only two poles in the release area posed no risk to Ridgway's Hawks. EDM generated a material list for 99 poles describing how to use insulation to retrofit each pole. In tandem with the inspection, samples of retrofitting products from Kaddas, Power Line Sentry, and TE Connectivity were given to the power company. We estimate the cost of materials needed to retrofit the 99 poles at $14,700 USD.

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**Use of Custom-Fitted Cover-Ups to Reduce Power Outages and Mitigate Avian Electrocutions in AltaLink substations in Alberta, Canada**

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One of the leading causes of electric system outages in substations is birds and other wildlife shorting out substation equipment. In 2003, in an effort to prevent electrocutions and improve system reliability, AltaLink began testing a new, custom fit line of insulating products. The products, called GreenJacket, are unique to other cover-up products because they are custom fitted to equipment of all shapes and sizes. AltaLink has installed GreenJacket in over 80 of their 280 substations as part of a formalized program and standard product, where all new substations are outfitted during construction and existing substations are prioritized and retrofitted annually. The goal of AltaLink's GreenJacket cover-up program is to improve the reliability of our transmission system while minimizing emergency call outs, costly outages to customers, and damage to equipment, while simultaneously protecting wildlife, including birds. AltaLink's maintenance savings are derived from avoidance these negative consequences. To date, the GreenJacket program has reduced wildlife outages by > 95% at sites with installations, has reduced our System Average Interruption Duration Index (SAIDI; the average outage duration for each customer served) by > 8% and reduced our System Average Interruption Frequency Index (SAIFI; the average number of interruptions that a customer experiences) by > 3%. In addition to SAIDI and SAIFI reliability results, we will discuss other elements of the program, including drivers (e.g. pre- and post-application outage statistics, incurred costs resulting from outages), a detailed cost-benefit analysis, and unique challenges and learning associated with working with novel insulating materials.

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**Modeling and Predicting Flight Altitudes of Raptors Crossing Large Water Bodies**

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To assess impacts of offshore installations, like wind farms, on raptor populations we need to know at what altitudes birds fly. Raptors, which normally rely on uplift from thermals during migration, are potentially more prone to collisions over large expanses of water, where thermals are not produced. To explain and predict flight altitudes over water, we used laser range finders to collect data on flight heights at different sites in Denmark and Sweden and related these to meteorological and topographical variables. We used a generalized additive mixed modelling approach to account for strong spatial and temporal autocorrelation in the flight tracks. Wind direction and distance to departure coast were generally most important, though flight altitudes and responses to meteorological conditions were clearly species and site specific. Other influential variables were wind speed, air pressure, and clearness. Raptors flew generally higher in tail winds compared to head winds and higher in clearer weather with higher air pressure. We assessed the accuracy of our predictions by comparing model predictions to flight tracks withheld for model verification. The Spearman's rank correlation between observed and predicted flight altitudes was high, ranging from 0.48–0.75, indicating that the predictive abilities of the models were good. Our model enabled us to predict mean flight altitudes during various weather conditions. Our models showed the risk of colliding with wind turbines was highly dependent on prevailing weather conditions and species-specific. Our approach makes it possible to incorporate the effects of wind and weather in studies regarding possible impacts of man-made structures on birds. Importantly, our model provides a basis for assessing flight heights of raptors over large areas prior to infrastructure projects, and could potentially be applied as a mitigation and planning tool.

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**Ecological Factors Driving Uptake of Anticoagulant Rodenticides in Raptors**

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Anticoagulant rodenticides (ARs) are the primary compounds used to control rodent infestations worldwide. Second generation ARs (SGAR) are gradually being recognized as persistent, bioaccumulative, highly toxic compounds (PBTs). The spread of SGARs as contaminants to raptors is increasing, and concentration levels are concerning given that we know little about potential sub-lethal and long term population effects. For example, over the past two decades, SGAR monitoring of owls in south western British Columbia, Canada has revealed a steady increase in exposure in the proportion of owls found dead; from 70% (n = 164) 1988–2003 to 96% (n = 111) 2005–2011. Further, many threatened and endangered raptors, including Red Kites (Milvus milvus), Barn Owls (Tyto alba), and possibly Northern Spotted Owls (Strix occidentalis caurina) are increasingly impacted by AR exposure. Our objective was to conduct a literature review to help gain an understanding of the ecological factors causing AR exposure in non-target raptors. Specifically, what are the typical traits of the species affected, what are the most common exposure pathways and how does landscape and environmental management influence exposure. Raptors affected by secondary AR exposure are typically scavengers or generalist consumers, with small mammals as an important component of their diets. Studies have also documented exposure in raptors that consume small avian prey, indicating either pervasive contamination of the food chain or that these raptors are opportunistically taking advantage of easily attainable poisoned rodents. Generally, exposure to AR compounds is clustered around areas of human development where there is a greater need for rodent control. Future research needs will also be discussed, including challenges of measuring sub-lethal effects, understanding populations level impacts, and interspecies sensitivity to different AR compounds.

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**Declining Populations of the Long-eared Owls and Snowy Owls in Montana and Alaska: Results of Long-term Research *(withdrawn)***

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After 27 years of year-round research on Long-eared Owls (Asio otus) in western Montana, and 22 years of breeding season research on Snowy Owls (Bubo scandiacus) and Brown Lemmings (Lemmus trimucronatus) in Alaska, a clear downward trend is apparent. Reasons are speculative, but habitat change and loss are the most likely influences

in Montana, and the effects of climate change on lemming population fluctuations in the arctic ecosystem may be important in Alaska. The Long-eared Owl's downward trend is consistent with other temperate zone species occupying open habitats. Populations of Long-eared Owls in Canada and the United States were estimated at 15,000 (9,000 in Canada and 6,000 in United States). If correct, the Long-eared Owl population estimate is similar to those of Flammulated Owls (Psiloscops flammeolus) and Spotted Owls (Strix occidentalis), both of which have federal, state, and regional conservation concerns. Furthermore, the Long-eared Owl population estimate is the lowest for any owl species in the United States. In contrast, one report estimated the Snowy Owl population to be 100,000 in North America. In a separate population genetics study the world estimate for female Snowy Owls is about 14,000. For Long-eared and Snowy Owls, both species are highly migratory, irruptive, and perhaps nomadic, which complicates monitoring and gathering of reliable population estimates. Furthermore, over time habitat does naturally change, a fact we often forget, and this too could influence populations. It is uncertain whether results from local long-term studies are applicable throughout a species' range. Nonetheless, local long-term studies provide valuable information for alerting conservationists and managers to changes in animal populations. Supporting comprehensive research and monitoring programs can be implemented across a species' range if justified.

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**Habitat Selection by Black-shouldered Kites (Elanus caeruleus) in Agroecosystems of Swaziland**

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Throughout Africa, many raptor populations have declined, which may contribute to a loss of ecosystem services such as pest control. The Black-shouldered Kite stands out as an exception, expanding its range due to its proclivity for using agricultural landscapes. To maximize the rodent pest control services these small-mammal specialists can offer farmers, we must understand the kite's distribution and habitat preferences. During our ongoing field season to be completed by the time of the conference, we will survey for kites along 400 km of main and secondary roads. We will use occupancy modelling to estimate site use throughout our study area. We will model site use with covariates at a landscape scale, a site scale, and a perch scale. Landscape covariates will include proportion of land cover type (agriculture, mixed use, riparian, and reserve) used and distance to agricultural zones. Site scale covariates will include proportion of land cover type (consisting of 14 classifications) used, and perch-scale covariates will include percent site consisting of sugarcane, herbaceous/grass, shrub, and bare ground, tree density, and perch type used (tree or power line). Our study will take place in agroecosystems of eastern Swaziland from May to August 2014. We expect to find that kites distribute themselves on the landscape in areas where reserves and agriculture are in close proximity to each other. Sites may be used more in areas with high proportions of wooded grasslands and sugarcane. Perches preferred are likely power-lines near low-to-medium tree densities with high proportions of herbaceous/grass cover. We will provide this information to Swazi farmers in the hopes that it increases their ability to promote kite presence, thereby enhancing pest control services as part of ecologically based rodent management programs.

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**Barn Owls (Tyto alba) in North America: Phylogeographic Structure, Connectivity, and Genetic Diversity**

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The implementation of genetic approaches is critical to making effective management decisions for populations with reduced gene flow or genetic diversity. The Barn Owl is a non-migratory species occupying most of the U.S. We conducted a range-wide phylogeographic study, with a focus on two separate populations: Santa Barbara


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Island, California (SB) U.S.A., and British Columbia (BC), Canada. SB Barn Owls have been suggested as responsible for the decline of a nesting population of Scripp's Murrelet (Synthliboramphus scrippsi). Translocating SB Barn Owls to mainland California has been suggested as a potential solution to increase Scripp's Murrelet numbers. However, such management action may be futile if dispersal from mainland California to SB is frequent enough to re-establish the population. In comparison, the BC population, which is federally listed as threatened, is experiencing population decline primarily as a result of habitat degradation. There are concerns regarding whether genetic diversity is compromised by diminishing numbers. Based on a total dataset consisting of eight polymorphic microsatellite markers (n = 126) and mitochondrial DNA sequences (950 base pairs, n = 42), we showed that the SB population exhibited recent divergence, suggesting demographic isolation. Accordingly, translocation may be a feasible management option from a population genetics perspective because dispersal from mainland California is rare. In comparison, high degree of gene flow across the western continental range has allowed the BC mainland population to maintain substantial genetic diversity (HS = 0.716). However, individuals from Vancouver Island are genetically depauperate, likely as a result of the population's insularity (HS = 0.656). On a more global scale, we found that Chilean samples are genetically similar to the North American samples despite being designated as two separate subspecies. Australian subspecies, on the other hand, are 8–9% divergent, suggesting that they should warrant their own species-level designation.

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**Restoring Aplomado Falcons to the United States**

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Captive-bred fledgling Aplomado Falcons (Falco femoralis) were released along the coastal plain of southern Texas (839 birds from 21 sites during 1993–2004) and in the Chihuahuan Desert of western Texas (637 birds from 11 sites in 2002–2011) and southern New Mexico (337 from 10 sites during 2006–2012). The Texas coastal releases yielded two nesting populations: 15 to 18 pairs near Brownsville and 15 pairs on two islands near Rockport. Habitat in these areas is extensive open savanna, the ancestral condition for most of the region. Today, it is almost entirely dominated by farmland and brush land, the latter harboring Great Horned Owls (Bubo virginianus), a major predator of Aplomado Falcons. Conversely, releases in the Chihuahuan Desert have been unsuccessful in establishing a wild population. Although 8–10 pairs were present in western Texas in 2009, by 2011 only one pair remained, and none were found in 2012, the apparent consequence of severe drought. A single pair documented in New Mexico in 2011 was associated with artificial feeding of prey birds. We concluded that the conservation and expansion of Aplomado Falcon populations on the Texas coastal plain will require the protection and management of existing breeding territories, and the creation and management of more brush-free savanna. Persistent drought, the reduction of prey populations, and high rates of mortality from raptor predation appear to preclude the reestablishment of Aplomado Falcons in western Texas or New Mexico.

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**Genetic Variation of Bald Eagles (Haliaeetus leucocephalus) in the United States**

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Bald Eagles (Haliaeetus leucocphalus) were almost extirpated due to effects of dichlorodiphenyltrichloroethane (DDT). Bald Eagle populations are recovering since DDT was banned, but basic information such as the genetic impact of the DDT-induced bottleneck, levels of gene flow, the existence of conservation units, and the impact of reintroduction programs has not been thoroughly studied. This study focuses on using the mitochondrial control region to determine current levels of genetic variation in Bald Eagles from individuals representing many states in the Bald Eagle's range. Initial results indicate there is significant mitochondrial genetic variation throughout the species' range despite the DDT-induced bottleneck. We

will offer preliminary predictions regarding gene flow and the partitioning of genetic variation within and among populations using these findings, and provide more robust answers incorporating mitochondrial data with our ongoing studies using a next generation sequencing approach.

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**Perspectives on Northern Aplomado Falcon (Falco femoralis septentrionalis) Conservation Efforts: Was Intensive Augmentation Really Necessary?**

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Listing of the Northern Aplomado Falcon as Endangered in 1986 depended on evidence of widespread pesticide contamination and thinning of eggs from eastern Mexico, and on perceived declines and extirpation of the species in the U.S. But paucity of specimen records, contradictory impressions of past status, and allegations that the large majority of U.S. specimens were actually collected in Mexico cloud impressions of historical status. During recovery plan preparation, these concerns seemed less important than the possibility that the species was experiencing range-wide population declines in Latin America. Consequently, intensive population monitoring in eastern and southern Mexico was initially given high priority, but later demoted and only implemented 20 years post-listing. Establishment of Aplomado Falcons in the U.S. was originally deemed essential to providing protection from pesticide contamination in Mexico, but this strategy depended on a key and ultimately false assumption that organochlorine levels were lower in the U.S. than in Mexico. Although one recent study found that pesticide-induced reproductive failure does not currently threaten the species, data on productivity collected in 1977–1985 suggest that this may have been true at the time the species was listed Endangered. These facts, plus evidence of natural recolonization of New Mexico, interspecific transmission of a lethal adenovirus to reintroduction stock, and implications of the experimental, non-essential designation for all Aplomado Falcons in Arizona and New Mexico constrain and complicate evaluation of the benefits of releases of this species in the U.S. In the future, effective conservation programs for the Aplomado Falcon, if needed at all, must shift to Mexico and emphasize desert grassland and savanna preservation in the face of habitat loss to dryland farming and biofuel production, without promoting destruction of tropical and subtropical forest communities.

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**Policy Development, Guidelines, and Other Tools in the Toolbox to Protect Raptor Species at Risk in a Working Landscape**

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Alberta, Canada is home to a wide variety of ecosystems, from native grasslands in the south, to the Rocky Mountains on the western border, and the vast boreal forest to the north. With this diversity in landscape comes several species of raptors that breed, overwinter, or migrate through the province, some of which are endangered or otherwise at risk. Raptor species warranting special management in Alberta include Bald Eagles (Haliaeetus leucocephalus), Barred Owls (Strix varia), Ferruginous Hawks (Buteo regalis), Golden Eagles (Aquila chrysaetos), and Peregrine Falcons (Falco peregrinus). Alberta is fortunate to include some of the largest energy resources in the world. Whether it is oil and gas, oilsands (mining and in situ), or wind energy, development of these resources, and the associated transmission and distribution line network that serves them, is occurring at an ever-increasing pace. As wildlife managers within an energy-rich province, our challenge is to conserve raptor populations and recover endangered species, while facilitating sustainable development of natural resources. Threats to raptors from energy development include, but are not limited to, direct mortality (e.g., collision and electrocution), indirect mortality from associated infrastructure and road networks, nest disturbance, and in some cases, subsequent nest abandonment. We present a number of tools for mitigating effects of energy development on raptors, from policy and guidelines, to creative solutions in cases where policy gaps still exist. We will discuss opportunities realized and lessons learned from this northern working landscape.

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**Winter and Summer Ranges, and Spring Migration of Adult Rough-Legged Hawks (Buteo lagopus) Wintering in California and Nevada**

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In January and February 2014, we deployed nine 22–g GPS satellite transmitters on adult Rough-legged Hawks overwintering in western Nevada and central and northern California. This is the largest tracking sample of this species to date in North America. One PTT stopped transmitting 36 d after deployment (probable mortality), following a heavy snow event that forced the bird to move 60 km into an adjacent valley. Wintering birds generally remained on their initial capture ranges until heavy snow events forced localized (18–140 km) movements into adjacent valleys. The eight birds that migrated north followed several different pathways east and west of the Rocky Mountains to reach summer ranges from the Kenai Peninsula of southwestern Alaska (n = 1) to the north slope of Alaska (n = 5), and northwestern Nunavut, Canada (n = 2). Although the routes varied, we found marked convergence of pathways through the interior plateau of British Columbia and on the east side of the Rocky Mountains through central Alberta. Three birds (1 female and 2 males) captured in the same agricultural valley in Plumas County, California are now summering in completely different areas, from southwestern Alaska to northwestern Nunavut, separated by distances of 1,200–2,000 km. Males and females averaged similar travel times to their summer ranges, but the average departure date for males was 11 d earlier (29 March) than for females (9 April). We found no other age or sex biased behavior. Arrival dates on summer ranges varied from 27 April to 21 May. Spring migration travel times ranged from 32–47 d ($\bar{x}$ = 37 ± 7.0 d [SD]). Travel distances ranged from 3,850–4,500 km ($\bar{x}$ = 3,992 ± 336.2 km). Average travel paces ranged from 104–145 km/d ($\bar{x}$ = 112 ± 24.9 km/d).

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**American Kestrel (Falco sparverius) Nest Box Relocations Increase Nest Box Use and Productivity**

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Throughout North America and Canada, studies of American Kestrels' use of nest boxes have indicated substantial population declines. In 2011, I initiated a pilot study on a small subset of the nest boxes in the Hawk Mountain Sanctuary nest box program. My study was designed to test whether provision of an additional nest box near an existing, used but mostly unsuccessful, nest box in the same habitat would increase use of nest boxes by, and productivity of, American Kestrels. To test this, I selected existing nest boxes which were disproportionately used during previous seasons. In 2011, when I first installed additional nest boxes and expected low occupancy, I found three of seven alternate boxes were used. By 2013, six of seven alternate boxes were used. From 2011–2014, productivity from this subset of boxes was 8, 17, 25, and 18 nestlings respectively. My results indicate a strategy of providing alternate nest boxes increased overall use and productivity of nest boxes. The positive trends found in this pilot study suggest this may be a useful conservation strategy to increase local populations of American Kestrels.

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**Eagle Mortalities and Injuries Associated with Electric Utility Infrastructure in the United States**

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The U.S. Fish and Wildlife Service (USFWS) has assembled and compiled records of Bald Eagle (Haliaeetus leucocephalis) and Golden Eagle (Aquilla chrysaetos) mortalities and injuries in the United States. The database includes records from several U.S. federal agencies, and approximately 10,000 records with mortalities and injuries attributable to several natural causes, such as disease, and to many anthropogenic factors, including approximately 3,300 collisions and electrocutions on overhead power systems. We will provide a summary and analysis of these collision and electrocution records. This will include a breakdown by eagle species and the number of mortalities and injuries. We will also present a summary of the geographic distribution for these records and the distribution over time (decadal analysis). Because most of the records were not the result of a systematic survey using a rigorous sampling protocol, many types of bias are associated with these records. We will fully enumerate the many types of bias associated with this sample of records. Despite these biases, this large sample is of scientific interest and has utility and relevance to management and conservation of Bald Eagles and Golden Eagles in the U.S.

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**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 (Surnia ulula) primarily breeds in boreal regions of Alaska and Canada. Northern Hawk Owls also can move southward into the contiguous lower 48 United States, occasionally breeding in states of northern latitude. In the contiguous states, Northern Hawk Owl nests are primarily documented in Montana and Minnesota. Since 1994, 15 nests have been documented from Glacier National Park and surrounding areas in northwestern Montana. Preliminary results from this study suggest post-fire forests are important habitat for these individuals. Nest trees were predominately deciduous (74%, n = 15) with average diameter at breast height (DBH) of 43.6 cm (n = 14). Nests were located in natural bowls (47%), natural cavities (30%), and excavated cavities (13%). Dietary analysis from pellets indicated voles were a predominant prey during breeding season, accounting for 89% (n = 230) of prey we identified. We will also present other discussions of distribution, habitat associations, and banding efforts from this ongoing study, with possible conservation and management implications.

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**Using a Roadside Survey Technique to Detect Short-eared Owls (Asio flammeus) and Potential Nesting Areas during Pre-nesting Periods**

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The Short-eared Owl is a grassland species that commonly breeds in Montana, and that is likely of national conservation concern. However, because this nomadic, nocturnal species is difficult to monitor, assignment of conservation status has been impeded. Information about the status of the Short-eared Owl population derives primarily from North American Breeding Bird Survey data and Christmas Bird Counts. Although these programs provide valuable information, they may be inadequate for evaluating conservation status. Thus, a 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. We conducted surveys in the Mission Valley of western Montana from 2009–2012. During these periods, we investigated visual and audio playback techniques for detecting Short-eared Owls. We found that visual, crepuscular surveys are most effective for documenting and measuring populations. Of our observations, 94% were visual rather than aural, and 62% occurred during the period of 40–70 min before the end of civil twilight. Our detections tended to occur (53%) in areas of uncut vegetation at least 30 cm tall. We will present these and other findings, along with suggestions related to the development of a continental monitoring strategy for Short-eared Owls.

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**Peregrine Falcons of the Lost Coast: Clarifying Subspecies along the Northern Gulf of Alaska**

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The concept of subspecies is an important tool to help categorize and conserve biodiversity. Delineating the range of a subspecies can have important management and conservation implications. The Peregrine Falcon (Falco peregrinus) is a widespread species that occurs throughout North America. Three North American subspecies are recognized: F. p. anatum, F. p. pealei, and F. p. tundrius. All 3 subspecies breed in Alaska, but their distributions in the state are somewhat unclear or unconfirmed, especially that of the F. p. anatum and F. p. pealei subspecies on the northern Gulf of Alaska Coast (i.e. the Lost Coast). We describe plumage, morphology, and movements of Peregrine Falcons known to have nested or been raised along the Lost Coast and we use this information to determine their subspecific group. We found plumage, morphometrics, and migration behavior consistent with F. p. anatum in an area previously thought to contain F. p. pealei. This is important because of the large declines that F. p. anatum suffered in the mid-1900s due to the effects of environmental contaminants. Our study underscores the importance of delineating geographic range and distribution of subspecies prior to environmental catastrophes, and to ensure reliable interpretation of species status and trends. We believe this type of basic life history and demographic information will prove to be more


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valuable as we realize the effects of a changing climate.

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**Season-Specific Selection of Land Use Types by Birds of Prey in the Southern High Plains: Implications for Wind Energy Development**

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Birds of prey are especially susceptible to collisions with wind turbines. Understanding season-specific associations of raptors across different land-use types can inform risk-based siting plans for wind energy development. Beginning in December 2012, we conducted monthly raptor surveys along a 1.6 km wide, 154 km long route in the Southern High Plains of Texas. Our goal was to assess season-specific raptor species presence, abundance, and associations with five land-use types: textile agriculture, grain agriculture, grazed grassland, ungrazed grassland, and other. In the first 15 months of surveys, we recorded detections of 1,071 raptors of 15 species. Each species analyzed used the land categories disproportionally to their availability in most seasons. Our preliminary data reveal a general pattern in which ungrazed grassland was used more than expected, grazed grassland slightly more than expected, and textile agriculture substantially less than expected, in all seasons. Grain agriculture use appeared to be season-specific. We also found species-specific differences in land-use type among seasons. For example, American Kestrels (Falco sparverius) used land-use categories in proportion to their availability in spring and fall, but not in winter or summer. Additionally, there were switches in land-use selection; American Kestrels used grasslands more than expected in most seasons, but switched to increased use of harvested grain fields in winter. Essentially, land-use types with higher raptor use can imply greater raptor-turbine collision risk. We will present completed analysis of 21 months of data collected from December 2012–August 2014.

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**Novel Approach to Quantify Power Line Collision Risk Using GIS and PLS-CADD**

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The Susquehanna-Roseland (S-R) project is a 500 kilovolt (kV) transmission line designed to replace an existing single circuit 230 kV line. The S-R line follows an existing transmission right-of-way spanning Kittatinny Ridge (Blue Mountain in Pennsylvania and Kittatinny Mountain in New Jersey) which is part of the Appalachian Raptor Migration Flyway. We collected fall migration data on Kittatinny Ridge in 2013 to identify baseline raptor movements across the existing transmission corridor to assess potential collision risks with the taller new line. Our survey protocol adhered to HMANA's standard data collection protocol for raptor migration monitoring. We used laser range finders to record the distance and angle of each crossing raptor. These data allowed us to calculate each raptor's spatial position as it crossed the proposed line. We merged these observations with a PLS-CADD transmission line design model, which depicted the proposed transmission tower structures and conductors in three dimensions. This approach allowed three-dimensional raptor locations and the proposed transmission line to be viewed together at any angle. We recorded 3,698 raptor crossings of the line corridor. We had a clear view of the existing 230 kV transmission wires for 679 hours, and did not observe any collisions with the existing line. Once imported to into ArcGIS 3D Analyst, we used crossing data to calculate whether birds were within the wire zone of the proposed line. Most raptors (72%) crossed above the height of the proposed transmission line. A few (4%) passed below the lowest proposed conductor height. The remaining 24% passed through the wire zone. Vultures comprised the greatest number moving through the wire zone (n = 607). Accipiters comprised the second greatest number moving through the wire zone (n = 189). This does not imply these birds will necessarily continue this flight behavior after the new line is constructed.

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**Migrating Tundra Peregrine Falcons (Falco peregrinus tundrius) Accumulate Polycyclic Aromatic Hydrocarbons along the Gulf of Mexico Following the Deepwater Horizon Oil Spill**

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Assessing internal oil exposure is critical to understanding the potential effects of this ubiquitous contaminant on wildlife populations and ecosystems. In 2010, the Deepwater Horizon oil spill (DWH) released 4.9 million barrels (780,000 m3) into the Gulf of Mexico, increasing concerns over acute and persistent exposure of wildlife to oil. We designed our study to assess temporal trends of crude oil exposure associated with the DWH. To do so, from 2009 through 2011, we measured circulating parent polycyclic aromatic hydrocarbons (PAHs), components of crude oil, in blood of migrating Peregrine Falcons captured at Assateague Island, Maryland, and South Padre Island, Texas. This sentinel species, a predator of shorebirds and seabirds during migration, was potentially exposed to residual oil from the DWH. Our results demonstrate increased PAH contamination in 2010 autumnal Peregrine Falcon migrants sampled along the Texas Gulf Coast after the DWH, particularly in juvenile females. We found increased percent occurrence (27%, $p = 0.038$) and mean ∑ PAH blood concentrations (4–fold, $p < 0.005$) in 2010 female migrants. Blood burdens also varied with age (juveniles 16.28 ± 1.25, adults-5.41 ± 1.10 ng/g) and PAHs detected, likely attributable to natural history traits. Increased PAH incidence (acenaphthene, fluorene, and pyrene) and the presence of other PAHs in peregrine blood suggest an additional crude oil source in 2010. Exposure metrics declined in 2011, yet increased anthracene incidence and the presence of alkyl PAHs, suggest petrogenic origins, differing from basal constituents. The analyses of PAHs in Peregrine Falcon blood provides a convenient repeatable method, with little disturbance to birds, for monitoring crude oil contamination in coastal environments and their avian prey base.

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**Falcons, Eagles, and Vultures: How Often Did Raptor Ecology Evolve in Birds?**

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We will report and describe the analyses of the mitochondrial genomes of three species of Accipitridae and one Falconidae. The birds include a Black-shouldered kite (Elanus caeruleus), a Striated Caracara (Phalcoboenus australis), Griffon Vulture (Gyps fulvus) and Cinereous Vulture (Aegypius monachus). Although we had intended to sequence a New World vulture that sample turned out to have been misidentified or mislabeled, and it really was Cinereous Vulture, an Old World, and not a New World vulture. Thus it is very important to always have good reference samples for comparison to sequence. Based on this experience, we hypothesize that there are problems in the literature where samples have been misidentified, or a nuclear copy of a mitochondrial gene has been sequenced (a 'numt'), or even hybrids of more than one genome may have been reported. Our results generally confirm that the families identified as falcons and as eagles have quite separate origins. Given also our earlier results with owls it appears that the 'raptor' lifestyle evolved on at least three, and probably four, occasions; namely owls, eagles, falcons and probably New World vultures.

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**Use of Existing Telemetry Equipment and Human Observers for Detection of California Condor (Gymnogyps californianus) and Avoidance of Mortality at Wind Farms in the California Desert (withdrawn)**

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The western boundary of the current range of the California Condor lies approximately 24 km west of the Tehachapi Wind Resource Area (TWRA) located in the Mojave Desert of California. While there are no documented occurrences of California Condors within the TWRA, future increases in the population and possible expansion of occupied range may bring condors into areas where wind turbines operate. To avoid possible collision mortality of California Condors at wind turbines, we developed and deployed a system that allows wind resource area operators to use VHF receivers to detect the signals from radio tags already deployed on California Condors. By using VHF signal strength and relative direction, observers can determine if a condor enters a 32 km area surrounding the wind farm and determine if curtailment (temporary shutdown of selected turbines) should be implemented to minimize a collision risk. This detection and avoidance system has been evaluated and accepted by the U.S. Fish and Wildlife Service and has resulted in a Biological Opinion including the first lethal take authorization for California Condor for


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a renewable energy project. The components of this system and how they are used at an operating wind farm will be described. Several scenarios will be illustrated describing how California Condors trigger the detection system, how the detection system alerts observers, and how observers and TWRA operators respond.

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**Lessons from the First Two Years of the American Kestrel Partnership's Nest Box Program: Results and Future Directions**

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American Kestrel (Falco sparverius) populations have experienced steady declines across much of North America since at least the late 1960's. Reasons for the decline remain a mystery. The Peregrine Fund founded the American Kestrel Partnership in 2012 to unite citizen scientists and professional scientists in an effort to study and conserve American Kestrels throughout the species' range. Since its inception, the American Kestrel Partnership has coordinated the development of a network of American Kestrel nest boxes across the Western Hemisphere, with each nest box monitored by members of the American Kestrel Partnership. Partners check their nest boxes several times throughout the breeding season and record data regarding number of eggs and nestlings, occupancy of starlings, etc., and enter their data into the American Kestrel Partnership's interactive website (http://kestrel.peregrinefund.org/). We plan to use these data to expand understanding of the demography of the American Kestrel and, ultimately determine the underlying cause or causes of American Kestrel declines. Here, we discuss the lessons learned in the first 2 years of developing the American Kestrel Partnership's nest box network. We present results regarding determinants of nest box occupancy including habitat associations, and height and orientation of nest boxes. We also discuss our plans to further elucidate the causes of the decline of the American Kestrel.

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**Coming to Terms: Why We Need to Use Consistent Terms to Describe Territory Occupancy and Breeding Activities**

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Inconsistent and ambiguous terminology can make it difficult to interpret and compare scientific results. Inconsistent use of the term "active" in the raptor literature may lead to confusion, particularly about long-lived raptor species that occupy nesting territories but do not lay eggs every year. Sergej Postupalsky defined the term "active" in 1974 to refer to raptor nests or territories containing eggs or young. Nearly 40 years after his recommendations, many raptor researchers still use the term "active" in different contexts, and many fail to define terms used to describe territory occupancy and breeding activities. We reviewed articles in the Journal of Raptor Research from 1973 through 2013 and found 102 that used the term "active" to describe nests, territories, or breeding areas. We also found 16 articles published from 2010 to 2013 in other wildlife journals that used the term. Only 41 (35%) of these 118 articles defined the term "active" in their papers. Of these 41, only 26 (63%) defined it consistently with Postupalsky's definition. Other definitions expanded the concept of "active" to include the presence of adults or a refurbished nest: evidence usually used to confirm an "occupied" nest or territory. As Postupalsky noted 40 years ago, this lack of standardization often makes meaningful comparison of data from different studies all but impossible. We recommend avoiding the term "active" unless it is clearly and carefully defined, and we recommend using terminology recommended by Steenhof and Newton (2007) instead.

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**Snail Kite (Rostrhamus sociabilis) Satellite Telemetry Reveals Large-scale use of 'Peripheral' Wetlands: Implications for Habitat Management, Population Monitoring, and Exposure to Toxins**

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The U.S. population of Snail Kites, limited to Florida, declined substantially and became federally listed as

Endangered following massive hydrologic and agricultural changes to the Everglades. These changes apparently had unfavorable effects on the kite's apple snail prey. Research and monitoring based on VHF telemetry and color-banded birds have focused on these once-vast wetland systems and have assumed that Snail Kites rarely cross unsuitable habitat, even to seek refugia during droughts. Since 2007, we have collected 50,114 satellite-derived locations for 22 adult Snail Kites tagged throughout the species' range in Florida. Of these locations, 54% were outside the natural wetlands that comprise the altered remnants of the Snail Kite's historic range. These 'peripheral wetlands', as they have been called, include large water-management canals, agricultural drainage ditches, neighborhood retention ponds, and Storm-water Treatment Areas (STAs, designed to use native vegetation to filter pollutants from agricultural run-off). None of these areas are managed specifically for Snail Kites, nor have these areas been regulated as Snail Kite habitat or incorporated into the large and expensive monitoring effort devoted to this species. Agricultural chemicals in these areas may exceed safe levels. We provide results of analyses for copper, long used as a fungicide on citrus crops; and inorganic mercury, precursor to a methylated form toxic to most species of vertebrates. Sub-lethal levels of mercury (3.3–4.8 ppm) in Snail Kite samples from the southern Everglades reached concentrations known to reduce nesting success by > 30% in other species of invertivorous birds. Our results indicate the created wetlands in which Snail Kites spend much, if not most, of their time pose serious challenges for the management and conservation of this imperiled species.

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**Movements of Juvenile Bald Eagles (Haliaeetus leucocephalus) near the Chesapeake Bay, Virginia: Implications for Bird Aircraft Strike Hazard**

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Over 142,000 bird-aircraft strikes have been reported in the U.S. since 1990, resulting in 25 human fatalities and annual economic losses estimated at $639 million. From 1990 through May 2014 a total of 18 Bald Eagles were struck by aircraft in Virginia, with half of those strikes occurring in the first 5 months of 2014. One of the largest concentrations of Bald Eagles occurs around the Chesapeake Bay where there is also a high density of civilian and military airports. Importantly, Bald Eagle behavior near airports is poorly understood. To guide management and reduce aircraft strike hazard involving Bald Eagles, we captured and telemetered 9 nestling Bald Eagles near military airports in 2013. Eagles fledged from 16 May through 13 June and dispersed from natal areas from 14 July through 31 August. Ninety-five percent of pre-dispersal, post-fledging locations from each bird were within an average of 997 ± 149 m (± SE) from its nest. The maximum pre-dispersal flight from the nest was 14.5 km, one-way. Fledged eagles flew at low altitudes (< 65 m above ground) until mid-July, flight altitudes increased appreciably (> 175 m) thereafter. On average, juvenile flight altitudes above ground level were highest during July (199 ± 29 m) and August (207 ± 31 m) and lowest during January (83 ± 11 m). Mean dispersal distance was 244 ± 66.7 km; seven eagles dispersed north, one east and one south. Following dispersal, every Bald Eagle we tracked flew within 500 m of an airport (n = 4473 points). Most points near airports occurred during April (n = 2435) and July (n = 1290). Our preliminary results suggest that juvenile Bald Eagles are most at risk for aircraft strike immediately upon dispersal from natal areas and during late spring.

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**Floater Interferences and Fecundity in Spanish Imperial Eagles**

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We report on an 11 yr study of floater interference in a population of Spanish Imperial Eagles (Aquila adalberti). We analyzed changes over the years in the fecundity of 15 territories to test predictions of two hypotheses of density dependent fecundity in relation to the presence of floaters. According to the "interference" hypothesis, as density increases, the frequency of floater intrusion increases, resulting in a decrease in fecundity. Thus, a negative relationship between floater intrusions and fecundity of the territory is predicted. In contrast, the "habitat heterogeneity" hypothesis, predicts as density increases a greater proportion of individuals are forced to occupy


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lower quality habitats and, at least up to a certain level, no relationship between floater intrusions and fecundity is expected. Floater Spanish Imperial Eagles tend to visit natal populations during the beginning of the breeding cycle. We found that among floater Spanish Imperial Eagles, males made significantly more intrusions per day than females, but females stayed in the natal population longer each year than males. Floater intrusions and fecundity were highly positively correlated, supporting the "habitat heterogeneity" hypothesis. Individuals are apparently able to assess the quality of a territory and at the frequencies observed, their interference with the breeding pair had no obvious depressing effect on fecundity.

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**New Transmitter Technology: Embracing the Potential While Understanding the Limitations**

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New technology has allowed investigation of questions about raptor ecology that previously have been difficult to answer using banding or observational data. Collection of data at global, regional, and local scales has been facilitated by recent generations of solar Argos GPS PTTs and GSM/GPS transmitters. For example, allowing identification of long-distance migratory pathways and distant wintering sites, providing new information about regional dispersal movements and settling areas, and gathering more detailed information at the local scale about home range and habitat use. However, due to the cost of individual transmitters and website data acquisition, researchers should be sure that the type of transmitter used is appropriate for the questions being addressed, and should consider the capabilities and limitations of the technology when designing studies. Ethics demand that researchers make every effort to evaluate effects of transmitters, if used, on individuals of their study species. We evaluated solar Argos GPS Platform Transmitter Terminals and 3 different GSM/GPS transmitters in our studies of Crested Caracaras (Caracara cheriway) in Florida for suitability in addressing questions with both short- and long-term focus. Differences in data quantity and quality and in tolerance of the various transmitter types by the tagged caracaras influenced our assessment of individuals' home range and habitat use, and of the suitability of different units for addressing questions requiring multi-year data collection. Data collected provided some exciting new findings, for example, Crested Caracaras apparently do not use different areas within their home range in any pattern during the day.

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**Northward Migration by Non-breeding Golden Eagles from the Southwestern United States**

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Other than wanderings by some non-breeding individuals, Golden Eagles (Aquila chrysaetos) in the contiguous United States generally are thought to be year-round residents. Twenty-two fledgling Golden Eagles that we marked with GPS Platform Transmitter Terminals (PTTs) in northwestern New Mexico, southwestern Colorado, and northeastern Arizona during 2010–2012 survived >1 yr. Nine (41%) of the eagles abruptly moved northward 370–1,240 km from areas near (<100 km) their natal sites during late spring, when 12–14 mo old. Four of these Golden Eagles were monitored from spring 2010 (one individual) and 2011 (three individuals) through spring 2013. All four settled in northerly ranges in May and remained as late as November, then migrated back to natal latitudes, generally following the routes of their northward spring migrations. The sole migrant eagle marked in 2010 exhibited similar migration timing and route use during 2011 and 2012, and its summer range the second year was about 80 km from that used the first year. Migrations were completed in 2–8 days. Seventeen Golden Eagles marked with PTTs in 2013 were added to the sample of potential migrants in spring 2014. As of mid-May, three of these had migrated northward. Finally, two of three territorial adult Golden Eagles marked with PTTs in winter of early 2011, did not nest that year, but subsequently migrated northward. Our data suggest that from May to September a substantial

proportion of non-breeding Golden Eagles from the southwestern United States migrate to and reside in more northerly regions.

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**Nestling Weight Strategies are Very Different in Peregrine Falcons and Turkey Vultures**

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In many raptor species, larger nestlings of each sex tend to have higher post-fledgling survival, perhaps indicating an individual's ability to survive periods of starvation. I recorded nestling weights and estimated ages while banding 302 nestling Peregrine Falcons (Falco peregrinus pealei) from 1980–2013 at Langara Island, B.C., and 106 nestling Turkey Vultures (Cathartes aura) from 2008–2013 in east-central Alberta. Of the Peregrine Falcons, four band recoveries from dead birds, one autumn-trapped first year migrant, and eight band resightings on breeding birds were almost all from the heavier half of the respective sex-age when banded. Of the Turkey Vultures, two band recoveries and 19 resighted birds showed no such pattern. I.e., heavier nestlings did not have a higher likelihood of surviving. Remarkably, it seems that the Turkey Vultures' way of life may not rely on surviving periods of starvation. Many banders do not weigh or measure birds, but they should because sometimes taking time-consuming measurements can pay off in unexpected ways. For example, it might be possible to sex nestling Turkey Vultures by measurements of foot pad or head length, but exploring this potential is only possible if measurements are collected and compared to DNA analyses.

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**The Influence of Agriculture and Energy Sector Development on Ferruginous Hawk Nest Reoccupancy**

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The cumulative effects of energy sector development can potentially influence Ferruginous Hawk (Buteo regalis) nest reoccupancy and reproductive success by changing the habitat suitability of a home range and nest site. Understanding factors influencing nest reoccupancy have particular importance in Canada where the northern edge of Ferruginous Hawk distribution has contracted by 50% since the 1980's. We examined how 1) land cover composition and energy sector development, 2) previous nest occupancy and outcome, and 3) interspecific competition influences Ferruginous Hawk nest reoccupancy in southern Alberta and Saskatchewan, Canada. From 2010 to 2014, we conducted 750 reoccupancy surveys at 445 individual nests where occupancy and nest fate were known for the previous year. We selected nests based on home range characteristics such as land cover composition and intensity of energy sector development. Nests were located in landscapes with 0% to 100% native prairie, and within this gradient we selected nests located in high or low densities of oil and gas development. We found 62% of nests were occupied the next year by Ferruginous Hawks and 10% by other species including Great Horned Owls (Bubo virginianus), Canada Geese (Branta canadensis), and other Buteo species. Nest reoccupancy was more likely in landscapes with moderate to high proportions of native prairie and at nests that fledged at least one young the previous year. We will compare nest reoccupancy rates across density gradients of oil and gas wells, power lines, and roads to identify possible mechanisms such as interspecific competition, nest site availability, and human disturbance. Our results may have significant implications for conservation and recovery of Ferruginous Hawks because energy sector development continues to increase in Canada resulting in a widespread human footprint.

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**Movements, Mortality, and Population Effects in White-tailed Eagles (Haliaeetus albicilla) Studied via GPS Satellite Telemetry and DNA at Smøla Wind-power Plant, Norway *(withdrawn)***

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Birds are negatively affected by wind turbines through two main processes: collision mortality and disturbance. The severity of this conflict is likely to vary depending on species, site, and season, with large soaring birds among the most vulnerable. At a 68–turbine wind-power plant at Smøla, coastal mid-Norway, White-tailed Eagles are frequent collision victims. Using GPS satellite telemetry,


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we studied movement patterns and collision risks. Juvenile birds stayed quite close to the wind-farm area during their first year of life, then roamed extensively thereafter. We subjected molted feathers from adults and feathers from nestlings to DNA analysis, enabling us to track the origins of collision victims. We found the White-tailed Eagles breeding within 5 km of turbines were affected by the power plant in several ways. Specifically, the replacement rate (net reproductive rate, R0) was below 1, so they experienced negative growth ($\lambda < 1$), and their generation time decreased with decreasing distance to turbines. The most influential demographic parameter in the population model was adult survival. We also found that molted feathers of many birds could not be classified as breeders, indicating the presence of a relatively large proportion of floaters on the island. Our findings show how poor siting of a wind-farm can induce increased mortality and affect the population dynamics of a large raptor in its breeding habitat.

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**Fall Raptor Migration Patterns and Climate Change in Western North American: Not the Same Thing Everywhere for Every Species**

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HawkWatch International (HWI) has conducted counts of migrating raptors at a network of sites across the western U.S., many for over 20 years. We use fall raptor migration counts and hourly weather observation data from HWI's network of sites in the western U.S. to explore regional shifts in weather patterns in light of global climate change. We also use these data to look for links between global climate change and migration patterns in migrating diurnal birds of prey. Given that impacts of climate change vary both spatially and temporally, we compare weather patterns over time between sites from the Pacific Northwest, Intermountain West, and Gulf Coast regions, and the impact these have on the overall volume and phenology of the fall raptor flight and on select individual species.

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**Using an Artificial Roosting and Nesting Structure for Passively Relocating Great Horned Owls (Bubo virginianus) from an Industrial Gas Plant: A Summary of the Design, Effectiveness, and Lessons Learned**

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In 2002, we designed and installed an artificial roosting and nesting structure to passively relocate a pair of Great Horned Owls that had occupied a building within the Lost Cabin Gas Plant operated by Burlington Resources (now ConocoPhillips Company) in central Wyoming. To maintain territorial occupancy and thereby exclude other owls from the immediate area, we placed the structure nearby, approximately 600 m from the plant. The height, length, and width of the structure each measured approximately 3 m with a peaked roof (like a small house), and we elevated the structure approximately 10 m above the ground atop four wooden power poles. A metal frame consisting of angled iron provided ample perching and roosting locations inside the structure. The open underside, along with several openings on the wind-protected side, provided multiple entry and exit points. We also incorporated a large nest box in the front of the structure. Within 24 hrs of installation, the pair of owls began roosting inside the structure, and the structure has been occupied annually and mostly year-round since it was installed. We have made several modifications over the years to better protect the nest box from the elements and to facilitate branching by owlets. In 2010, we installed webcams to improve monitoring of nesting activity. Since installation, we have documented at least nine nesting attempts within the nest box, and young have fledged on at least three occasions. Although the technique of providing alternative safe nesting structures is used widely with other raptor species, it is not commonly reported for Great Horned Owls. Furthermore, our design accommodating roosting and nesting for year-round occupancy appears to be unique, but may be applicable to other locations and circumstances.

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**A New Raptor Watch Monitoring Site in Belize: First Year Results with a Focus on the Hook-billed Kite**

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The Belize coastline bordering the Caribbean Sea acts as a leading line for south-bound migrating raptors en route to their wintering grounds in Central and South America. In 2013, the Belize Raptor Research Institute in collaboration with the Toledo Institute for Development and the Environment and Ya'axche Conservation Trust, launched the first annual autumn raptor count in Belize. We conducted daily standardized counts from 15 September to 7 December from 08:00 to 16:00 at the Cattle Landing soccer field north of Punta Gorda in the Toledo District. In 642 count hours during the first count season, we observed 8,457 raptors, of which 2,897 (34%) were migrants, representing 32 of the 46 diurnal raptor species (70%) recorded in Belize. The mean number of raptors we counted was 13.2 per hr, including non-migratory individuals. Count totals for the five most common migrant species were: 817 Mississippi Kites (Ictinia mississippiensis), 744 Hook-billed Kites (Chondrohierax uncinatus), 434 Peregrine Falcons (Falco peregrinus), 376 Ospreys (Pandion haliaetus), and 348 Broad-winged Hawks (Buteo platypterus). This count-site is exceptional in that it has the largest reported concentration of migrating Hook-billed Kites anywhere in the species' distribution. Where these individuals are migrating from is unknown, but we hypothesize they are from a population on the Yucatán Peninsula migrating due to low snail detectability during the dry season. Of the 744 Hook-billed Kites we observed, 61% that we identified to gender were females, 51% that we aged were adults, 49% were juveniles, and 48% that were categorized by plumage type were dark morphs. Two Belizeans were hired to coordinate this project and more than 100 community members and schools participated at or visited the count-site, making this first year a success for research, and for community education and outreach.

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**Golden Eagle Nesting Distribution and Productivity in Relation to Energy Development in Wyoming's Bighorn Basin**

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We have been studying Golden Eagle (Aquila chrysaetos) nesting ecology in the multi-use landscape of the Bighorn Basin, in northwestern Wyoming since 2009. Our study area encompasses the Oregon Basin oil and gas field, one of the largest and most productive energy-producing areas in the western United States. Nest area occupation, success, and productivity have fluctuated dramatically during the study period, related closely to fluctuating cottontail (Sylvilagus species) abundance. Through the use of multivariate statistical techniques, we have been able to demonstrate that productivity is associated with a complex suite of landscape features and human activity. The effect of oil and gas development and associated human activity on Golden Eagle productivity depends on the quality of nesting substrate and prey availability. Assessments of the impact of proposed energy development on Golden Eagle reproduction should therefore consider fundamental species requirements and the broader habitat context.

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**Successful Restoration of Bald Eagles (Haliaeetus leucocephalus) on the California Channel Islands**

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Bald Eagles were extirpated from the California Channel Islands by the early 1960s, likely as a result of dichlorodiphenyltrichloroethane (DDT) contamination in the Southern California Bight. We began restoring Bald Eagles to Santa Catalina Island in 1980 and the northern Channel Islands (NCI) in 2002. Eggs on Santa Catalina Island failed to hatch in 1987 and 1988 and exhibited high levels of DDE contamination, a metabolite of DDT. For the next 19 years we maintained the population through artificial incubation and hacking of birds, whereas nests on the NCI were not manipulated. The first confirmed natural hatching of Bald Eagles on the NCIbsince 1950 occurred on Santa Cruz Island in 2006, followed by nests on Santa Catalina Island in 2007. All nest manipulations stopped after 2008 and the breeding population has now grown to 18 breeding pair on four islands. Average productivity from 2009–2013 was 0.97 fledglings per breeding attempt with 65% of breeding attempts resulting in the fledging of at least one chick. We found equal numbers of nesting attempts on Santa Catalina Island and the NCI (33 on each) over the 5-year period, but productivity and success rates were generally higher on Santa Catalina Island (1.24 chicks per attempt, 73% success) than on the NCI (0.7 chicks per attempt, 58% success). Although DDE contamination appears to have declined to a level that allows successful breeding by Bald Eagles on the California Channel Islands, we are continuing to monitor the population


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to determine whether DDE contamination could cause decreased productivity as the breeding population ages and accumulates higher contaminant loads.

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**Bioavailability of Antimicrobials in the Eggs of Two Species of Wild Birds Exposed to Municipal Biosolids**

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Despite the implications of elevated concentrations of antimicrobials in urban ecosystems, few studies have addressed the bioavailability, movement, and consequences of these contaminants at higher trophic levels in terrestrial environments. Triclocarban (TCC) and triclosan (TCS) are two of the most utilized antimicrobial compounds in consumer products. They can be introduced into ecosystems through a variety of sources including the application of wastewater biosolids to agricultural fields. We hypothesized that antimicrobials found in biosolids would be bioavailable and would negatively impact birds. To test these hypotheses, we measured the transfer of antimicrobials in land-applied biosolid, soil, worms, small mammals, and eggs of two bird species collected from an experimental (biosolids amended over a seven year period) and a reference (biosolids free) agricultural site. Liquid Chromatography–Mass Spectrometry was used to quantify the concentration of antimicrobials in biosolid, soil, earthworms, small mammals, and eggs of American Kestrels (Falco sparverius) and European Starlings (Sturnus vulgaris). We compared the concentration of antimicrobials in the eggs with egg morphometrics (egg length, egg mass, and egg shell thickness) and nesting success. Concentrations of antimicrobials were significantly higher in soil, earthworms, small mammal tissue, and eggs of starlings on the experimental site, but did not differ in the eggs of American Kestrels. We found no significant correlation between antimicrobial concentrations and egg morphometrics for either bird species. Nesting success for American Kestrels was significantly lower on the experimental site, whereas nesting success for starlings did not differ between sites. Our study demonstrates that antimicrobials from biosolids can be transferred to eggs of secondary and tertiary consumers. Contaminants from biosolids should be further investigated as a potential factor influencing the nesting success of birds.

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**Evaluation of Survey Protocol Recommendations for Golden Eagles**

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The U.S. Fish and Wildlife Service (USFWS) identified the need for a comprehensive survey and monitoring strategy for effective conservation of Golden Eagles (Aquila chrysaetos) in North America. In 2012 and 2013, we surveyed for Golden Eagles in Idaho, New Mexico, and Wyoming following methods recommended by the USFWS. Our intent was to inform development of a monitoring strategy by examining how estimates of detection and occupancy probability vary with survey effort. Despite 1,500 hrs of surveys, detections of Golden Eagles were too sparse for occupancy modeling in any of our survey areas. However, we were able to compare naïve occupancy estimates among survey efforts and evaluate yearly and seasonal variation in Golden Eagle detection. The number of Golden Eagle detections and naïve occupancy estimates varied considerably between years and between our two survey seasons. Additionally, we verified that survey radius and survey duration positively influence the detection of eagles. Although naïve occupancy increased with larger survey radii, the effect of survey duration on naïve occupancy varied by season. We were able to determine yearly, seasonal, and some survey-based differences in Golden Eagle detectability. However, our inability to detect sufficient numbers of eagles for occupancy modeling, coupled with the expense and logistical challenges of our effort, identify limitations on the usefulness of point count surveys for determining spatial and temporal use of an area


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by Golden Eagles.

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**Effects of Researcher-Induced Disturbance on American Kestrels (Falco sparverius) breeding in Nest Boxes in Northwestern New Jersey**

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Nest boxes for American Kestrels may alleviate local nest site limitation, but there is concern that periodically opening nest boxes or handling adults may negatively impact nesting success. From 1995 through 2012, I monitored 466 American Kestrel breeding attempts in about 100 nest boxes in northwestern New Jersey. To study return rates, I captured adults in nest boxes and marked them with USGS bands and patagial tags. To examine possible effects of this disturbance, I compared nesting success (≥ 1 chick surviving ≥ 18 d) of marked and unmarked adults. Success rates of 270 unmarked pairs, 19 pairs with only the male marked, 157 pairs with only the female marked, and 20 pairs with both adults marked were 67%, 74%, 78%, and 95%, respectively, a significant difference. This result likely reflects differences in the probability of capture: successful attempts last longer and successful parents may be more attentive. To control for these correlations, I examined attempts in which the first disturbance was encountering an adult in the nest box. For 358 females, 93% of those handled and 94% of those not handled continued the attempt (did not abandon). Nesting success also was similar, 78% and 79%, respectively. For 116 males, 93% of those handled and 94% of those not handled continued, and success rates, 83% and 78%, respectively, also did not differ significantly. Males were infrequently encountered in nest boxes during the laying stage, but 97% of all females (handled or not) first encountered in nest boxes during the laying stage continued, which did not differ significantly from those females disturbed during incubation (93%), and nesting success did not differ significantly (80% and 72%, respectively). Thus, it appears that both the intensity (handling or not) and timing of disturbance had no substantial effect on abandonment or nesting success in this population.

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**Tracking the Movements of Louisiana Bald Eagles**

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Bald Eagles (Haliaeetus leucocephalus) nest during the winter in Louisiana, but they are rarely observed in the state during summer. We used satellite GPS transmitters to provide evidence of their undocumented summer migrations and examined parameters such as timing of departures and arrivals, stopover use, routes used, and seasonal and annual repeatability of these parameters. Sub-adults departed Louisiana and arrived at their summering areas significantly earlier than did adults. All radio-marked individuals from our study migrated north for the summer, returning to wintering areas in Louisiana. Individuals spent about two months on their migration, flying relatively direct routes between Louisiana and their summering areas, displaying strong route fidelity and spreading out from British Columbia to Ontario, and north as far as the Northwest Territories of Canada. Using locations from their winter and summering areas, we estimated home range and core area size using Brownian bridge movement models. Home ranges varied from 8.8–1,997.7 km2, but on average, nesting Bald Eagles had smaller winter home ranges than did non-nesting birds. Radio-marked individuals exhibited a high degree of fidelity to winter home ranges and relatively high fidelity to summer home ranges. These results provide baseline information about the movements of Louisiana Bald Eagles, and illustrate challenges in managing a population that migrates long-distances over a vast geographical area.

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**Chemical Composition in the Fecal Matter of a Breeding Female Long-eared Owl & her Young Compared to Fecal Composition of a Male Long-eared Owl (withdrawn)**

*MARIA TESORO (mtonanmtinmt@gmail.com), Sentinel High School, Missoula, MT, and Owl Research Institute, Charlo, MT, U.S.A.

Breeding female Long-eared Owls (Asio otus) and their chicks have feces that smell distinctly worse than that of males. It is hypothesized that this is because females and chicks produce an odoriferous chemical excreted in their

feces to ward off predators. To test this hypothesis, we conducted data collection of fecal samples during a winter season (December–March), and a breeding season (May, June). We used Liquid-Solid Thin Layer Chromatography to analyze six samples. Our results were inconclusive, but some information was gained. We found very few compounds going into the solvent systems we used. The feces were slightly active under short wave light but not active under long wave light. When sprayed with Vanillin and Sulfuric acid stain, and then burned, there was no charring or changes in color in the area where the feces were. This demonstrates that the feces of non-breeding females and males contain benign compounds. Due to the breeding season of the Long-eared owls, data will also be collected this spring and summer. These data will be compared to data previously collected during winter months.

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**Coastal Raptors**

*DANIEL E. VARLAND (danvarland@coastalraptors.org), Coastal Raptors, Hoquiam, WA, U.S.A.

As the first presenter and moderator of the symposium on coastal raptors, I will begin by providing a brief overview of presentations in the symposium schedule. I will then characterize why raptors occur on coastlines and describe risks to raptors in coastal environments. Next, I will discuss the work of the non-profit organization, Coastal Raptors. Active since 1995 and with non-profit status since 2009, the goals of Coastal Raptors are to conduct scientific research, provide education programs, train wildlife biologists, and collaborate with experts in wildlife research and management. Coastal Raptors is currently engaged in two research projects, Long Term Monitoring of Raptors on the Washington Coast and Monitoring the Health of Avian Scavengers on the Washington and Oregon Coasts. For the first, we conduct line transect surveys by vehicle with stops along the way for raptor trapping. For the second, we trap avian scavengers from a fixed location. As of this writing, these projects have led to capture and marking of 206 Peregrine Falcons (Falco peregrinus), 26 Bald Eagles (Haliaeetus leucocephalus), 19 Turkey Vultures (Cathares aura), six Gyrfalcons (Falco rusticolus) and five Common Ravens (Corax corax). We collect blood samples, feather samples, throat swabs and cloacal swabs from trapped birds. I will conclude the presentation by sharing findings from our tests for contaminants and disease.

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**Monitoring Population Health of Swainson's Hawks (Buteo swainsoni) Through Immunocompetence in Northern California**

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We tested immunocompetence levels of Swainson's Hawks against multiple life-history traits to determine the efficacy of immune assays as tools to monitor population health. To do so, we collected blood samples from nestlings in conjunction with routine banding and population monitoring in Butte Valley, California. We used a bacteria killing assay to quantify mediated bactericidal capacity as a proxy for immunocompetence. We used several metrics to determine if immunocompetence was related to perinatal conditions: body condition at banding (i.e., weight adjusted for size), age at banding, territory quality assessed by occupancy rate of each territory over the last 25 yrs of monitoring, number of siblings, hatch order, and hatch date. We analyzed the data using a generalized linear mixed model to account for pseudoreplication of sampling from multiple individuals from the same nest. We used AIC to evaluate model performance. Our analysis showed that immunocompetence was positively correlated with territory quality, but negatively correlated with number of siblings. These results provide support for the idea that immune function is a trade-off with other life-history traits. Our results suggest that measures of immunocompetence have potential as bioindicators of wildlife health.

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**Behavioral Responses of Burrowing Owls to Experimental Conspecific Brood Parasitism**

**JAMIE WADE (jamiegroves@u.boisestate.edu), and JIM BELTHOFF, Department of Biological Sciences and Raptor Research Center, Boise State University, Boise, ID, U.S.A.

We investigated responses of Burrowing Owls (Athene cunicularia) to experimental conspecific brood parasitism to determine if Burrowing Owls are capable of egg discrimination, and to identify whether Burrowing Owls accept or reject a parasitic egg introduced into their nest.

Owl responses to parasitic eggs varied with nesting stage. Egg rejection predominated in nests where we introduced a parasitic egg during laying, but owls accepted parasitic eggs added during incubation. Parasitic eggs deposited early may pose a greater threat to host fitness because of increased chance of hatching, which may explain why more parasitic eggs deposited early were rejected. Responses to early parasitic eggs did not differ when we added an egg (clutch size increased) or when we swapped the parasitic egg for a host egg (clutch size did not change). This suggests that hosts rejected the parasitized nest based on presence of the parasitic egg and not solely based on increased clutch size. Size differences between host eggs and parasitic eggs, and degree of variability among eggs within host clutches, had no effect on rejection. Instead of selectively rejecting parasitic eggs, hosts buried them along with their own. We hypothesize this implies host owls could not remove the parasitic egg or were unable to recognize it. We also assessed changes in parental care by evaluating images from infrared cameras placed at Burrowing Owl nests. There were no differences in parental behavior between parasitized and non-parasitized nests. Thus, Burrowing Owls may either be unable to identify parasitic nestlings or unwilling to decrease parental care if the cost of doing so decreases their own offspring's survival. Our results are consistent with the notion that conspecific brood parasitism may be a part of the behavioral repertoire of Burrowing Owls.

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**Retrospective Analysis of Rehabilitated Cases in The Raptor Center, University of Minnesota from 1990 through 2013**

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We conducted a retrospective study to analyze records of raptors admitted to The Raptor Center at the University of Minnesota from 1990 through 2013. The aim of our study was to assess trends in admissions and outcomes over the past 24 years and correlate these with known changes in local populations of raptors. There were 16,731 individuals of 39 raptor species representing six orders; 15 Accipitridae (n = 8,499), 11 Strigidae (n = 4,794), eight Falconidae (n = 2,774), three Cathartidae (n = 163), one Pandionidae (n = 495), and one Tytonidae (n = 6). The top five admitted species were Red-tailed Hawk (Buteo jamaicensis, n = 2,938), Great Horned Owl (Bubo virginianus, n = 2,384), Bald Eagle (Haliaeetus leucocephalus, n = 2,199), Cooper's Hawk (Accipiter cooperii, n = 1,550), and American Kestrel (Falco sparverius, n = 1,540). Approximately 55% (n = 9,255) of admitted birds were immature and 36% (n = 5,991) were adult. Of 16,727 raptors for which the cause of admission was recorded, the most common was trauma (76%, n = 12,785). Of Bald Eagles, lead toxicity accounted for nearly 22% (n = 481). Nearly 58% (n = 9,679) of admitted raptors were hospitalized less than 1 week. Among birds that were hospitalized more than one week (n = 6,909), mortality was 33% (n = 2,262) and release rate was 61% (n = 4,187). Mean and median durations for successfully rehabilitated patients (n = 4,187) were 94.7 days and 51 days, respectively. The number of admissions from year to year declined in some species (e.g. American Kestrel), but increased in others (e.g. Cooper's Hawk and Bald Eagle). We will compare these patterns with abundance estimates from the USGS-Breeding Bird Survey for Minnesota and adjoining regions.

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**Eagle-Aircraft Collisions: An Increasing Problem in the Airport Environment**

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Recovery of the Bald Eagle (Haliaeetus leucocephalus) represents a true conservation success story. Bald Eagles have repopulated the majority of the species' historic range in the lower 48 United States. Given this recent expansion and continued population growth, the frequency of human–eagle conflicts is growing. Notably, the risk of eagle-aircraft collisions is an increasing problem at civil and military airports. A total of 234 eagle-aircraft collisions with civil and military aircraft were reported to the Federal Aviation Administration, the U.S. Air Force, and the U.S. Navy from 1990 through 2013, 52% of which caused damage to the aircraft. Eagle-aircraft collisions occur primarily during daylights hours (88%) and typically within the airfield environment. Concurrently, there is widespread public interest in eagles with a strong concern that eagle populations be protected. Following the "delisting" of Bald Eagles in 2007, important changes to key federal regulations regarding eagles, specifically the Bald and Golden Eagle Protection Act, occurred that have implications for aviation safety and eagle management at airports. Effective,

publically accepted methods to reduce collision hazards posed by eagles using airport environments are needed. Further, growing Bald Eagle populations will likely result in more eagle-aircraft collisions. Risks posed to aircraft by eagles are generally site-specific, and might involve varying age classes (e.g., juveniles, breeding adults) and life-history stages (e.g., foraging on or near the airport, actively nesting). Consequently, as part of an integrated wildlife damage management program, specific management efforts to reduce the risk of eagle-aircraft collisions must be tailored to each specific situation.

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**Using Brownian Bridges to Assess Potential Interactions between Bald Eagles and Electrical Hazards within the Upper Chesapeake Bay**

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One of the most effective strategies to minimize mortalities of large raptors due to collisions is to site infrastructure associated with collision hazards away from major activity centers of raptors. The lack of delineation of such activity centers on the landscape has been a significant impediment to progress in proactive infrastructure planning. We used Brownian bridge movement modeling to develop a population-wide, utilization probability surface for Bald Eagles (Haliaeetus leucocephalus) within the upper Chesapeake Bay. We used locations (n = 320,304) for individuals (n = 63) tracked with GPS satellite transmitters between 2007 and 2011 in our analysis. To identify intersections between power lines and eagle activity centers, we overlaid the probability surface and the electrical network within Aberdeen Proving Ground, a 350 km2 military installation. We overlaid line-attributed mortalities (n = 67) documented on the installation to assess the relationship between mortality rates and utilization probabilities. Areas of high Bald Eagle use were relatively rare on the landscape with only 0.1% and 5% of the area accounting for 10% and 30% of estimated utilization. Most electric lines were distributed away from eagle activity centers with only 0.3% of lines located within areas with the highest estimated use. Eagle mortalities were highly skewed to lines that overlapped with eagle activity centers. Eagle mortality rates were 42 times higher along lines associated with the highest eagle use compared to lines associated with the lowest use, suggesting that estimated utilization may be an effective proxy for mortality risk associated with electric line hazards. The majority (72%) of high-use Bald Eagle areas delineated within the study area have no existing electric lines. Utilization probabilities may be a potential tool for site-specific infrastructure planning.

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**Examination of the Behavioral use of Black and White Tail Coloration for Male American Kestrels (Falco sparverius)**

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Many birds of prey exhibit some form of plumage variability or polymorphism, yet little is understood about why so many species maintain such wide ranging color fluctuations. One prevailing proposition focuses on the potential behavioral use of highly variable plumage in intra- and inter-sexual interactions, such as for female choice of mates, or competition between males for territory size. To test this idea requires an in-depth understanding of the level and extent of the plumage variability for an entire species' range, and information on the inheritance and maintenance of the trait within individuals and families. American Kestrels exhibit high levels of sexual dichromatism, and variability in individual coloration for specific plumage traits, such as the 6th rectrices of males. We used multiple lines of evidence from museum collections, a captive colony, and wild nest box programs to analyze the potential behavioral uses of the highly variable black and white coloration on the 6th rectrices of male American Kestrels within North America. We divided tail patterns into three categories and four levels of variation. Using captive individuals, the patterns were highly heritable and showed little change between molt. We then examined the potential use of tail patterns as a behavioral signal at four nest box programs within Northern California. To test for effects of intra- and inter-sexual selection, we looked for correlations between the amount of black and white on the tails of males as proxies for female choice, the condition of parents during the breeding season, male parental effort, and the number of offspring produced. We found no significant relationships, and as such there appears to be no behavioral use of the tail coloration by male American Kestrels despite the high degree of maintained variability.

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**Long-term Standardized Studies of Migrating Tundra Peregrine Falcons (Falco peregrinus tundrius) on the East and Gulf Coasts of the U.S.**

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Range-wide dichlorodiphenyltrichloroethane (DDT) related declines among Peregrine Falcon populations led to endangered species status in the United States in 1970. Standardized autumn studies of migrating Tundra Peregrine Falcons were begun at two well-documented focal points of migration (Assateague Island, MD/VA, 1970, and Padre Island, TX, 1977). Padre Island was identified as the only known vernal migration concentration point in the Western Hemisphere, and spring studies were added there in 1979. To date we have expended > 50,000 person-hours in sighting approximately 64,000 Tundra Peregrines and capturing 14,639. Our long-term database on this subspecies since 1970 is unparalleled. Our data from Assateague Island can also be directly related to data collected from 1938 through 1969 by falconers and naturalists, effectively providing a continuous database of over seven decades at this migration focal point. Our data document the recovery of migratory Peregrine Falcon populations after the 1972 U.S. ban of DDT, and we plan to continue these monitoring efforts. We have tracked 58 peregrines from these study sites and coastal Mexico by satellite telemetry, defining migratory routes and areas of critical use by subjects and their associated prey species. We have archived thousands of blood samples from Tundra Peregrine Falcons, and found these apex predators are an effective bioindicator of environmental health. Samples can be analyzed to provide current and retrospective insights into known and emerging chemical and biological threats to the environment and to our living world. We documented the decline and virtual disappearance of DDE in Tundra Peregrine blood. We have also used samples in genetic and natal origin studies, as well as the investigation of West Nile Virus, Avian Influenza, and polycyclic aromatic hydrocarbons (PAH) contamination resulting from the 2010 Deepwater Horizon Gulf of Mexico oil spill. We intend to continue these important studies indefinitely.



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# Poster Session Abstracts

**Microsatellite Analysis of Parentage in Western Burrowing Owls Nesting in the Morley Nelson Snake River Birds of Prey National Conservation Area, Idaho, U.S.A.**

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Burrowing Owls (Athene cunicularia) are socially monogamous in that one male and one female typically form a breeding season pair bond and cooperate in parental care, although rare cases of social polygyny are documented. For many socially monogamous birds, we know that genetically determined parent-offspring relationships and those suggested by behavioral observations disagree. Genetic mismatches between nestlings and caregivers arise in at least two ways: extra-pair fertilization (EPF) and conspecific brood parasitism (CBP). CBP is expected to occur in species that nest in high density, where nesting sites are limited, such as when birds rely on nest cavities or burrows produced by other species, and host nests are available for extended periods of time, i.e., such as when clutch sizes are large. Burrowing Owls fit these criteria. Moreover, previous genetic studies of parentage in a small and declining population of Burrowing Owls in Davis, California indicated that EPF resulted in 5–10% of offspring (Johnson 1997). Our objective was to determine patterns of parentage in Western Burrowing Owls nesting within the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA) in southern Idaho where the Burrowing Owl population has been studied since 1996. Our study population differs from Davis, CA in that our population is not small or under severe decline. Thus, we will compare our results with those of Johnson (1997). We obtained DNA from owl blood and used microsatellite primers to detect instances of genetic mismatches between caregivers and nestlings. Our poster reports initial results of genetic parentage testing and discusses ecological correlates of genetic monogamy and polygamy for Burrowing Owls in the NCA.

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**A Preliminary Analysis of Golden Eagle Movements in Alaska**

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Alaska provides breeding habitat for many of North America's breeding Golden Eagles (Aquila chrysaetos). However, little is known about the home range sizes, migration movements to and from the breeding grounds, survival, and causes of mortality of Golden Eagles in Alaska. To better understand their ecology and migration, in the first year of a three-year study, we attached solar-powered satellite transmitters to adult (n = 10) and sub-adult (n = 5) Golden Eagles captured in Alaska. We captured eagles during spring migration in south-central Alaska in 2014. Adult eagles established home ranges near the capture site in south-central Alaska, and in the western Alaska Mountain Range. Sub-adults stayed in south-central Alaska or traveled to western Alaska or the Kenai Peninsula through spring and early summer. Preliminary results suggest home range diameter sizes for breeding individuals ranged from 7–22 km with a mean of 11.7 km; sub-adult movements included much larger areas. Understanding breeding and non-breeding season movements by this large population is critical to conservation and management of Golden Eagles.

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**Anticoagulant Rodenticide Occurrence in Red-tailed Hawks in Coastal California**

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In recent years there has been increased awareness about the effects of anticoagulant rodenticides on wildlife in general and on raptors specifically. Anticoagulant rodenticides are slow-acting, non-selective, and acutely toxic. Despite the potential for secondary poisoning, most data is collected on individuals that have been injured or are obviously already suffering from poisoning. We hypothesized rodenticide may also be present in raptors not obviously under stress. To evaluate this, we tested blood rodenticide levels in 20 Red-tailed Hawks (Buteo

jamaicensis) migrating through the Marin Headlands from August–December of 2013. We collected approximately 1.5 ml of blood from each individual, separated plasma by centrifugation, and stored it at -20°C until analysis. Five (20%) of the samples tested positive for anticoagulant rodenticides, including chlorophacinone (n = 3) and diphacinone (n = 2). We found no relationship between rodenticide exposure and body condition (i.e., wing/weight regression residuals). Despite the short-lived nature of rodenticides in blood (i.e., 5–7 days) 20% of the individuals tested positive, indicating high exposure levels. However, the levels found did not appear to influence individual body condition. In addition, one juvenile Red-tailed Hawk that had been carrying a GSM transmitter and that was later recovered deceased in San Francisco tested positive for lethal levels of difethialone.

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**Ecological Research and Monitoring of Threatened Vultures in Arghakhanchi, Nepal**

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Little is known of population trends for vultures in and around Arghakhanchi, Nepal, but concern exists that Diclofenac, a nonsteroidal anti-inflammatory drug provided to livestock, may lead to secondary poisoning of vultures. To evaluate and combat this, we studied the area's vulture diversity and breeding success from 2010 through 2014, and we initiated a local conservation outreach program. We monitored critically endangered White-rumped Vultures (Gyps bengalensis), endangered Egyptian Vultures (Neophron percnopterus), Himalayan Vultures (Gyps himalayensis), and Lammergeiers (Gypaetus barbatus). We will present analyses of population trends and breeding success for these species in the area surrounding Arghakhanchi. We will also describe various public awareness programs we initiated to encourage conservation actions by area residents, including newspaper articles, news broadcasts, questionnaires, a supporting website (http://www.rufford.org/rsg/projects/krishna_prasad_bhusal), and a supporting video (https://www.youtube.com/watch?v=ulrDMNIELas).

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**Home Range and Land Use of Urban Cooper's Hawks in Vancouver, British Columbia**

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We monitored nine adult Cooper's Hawks (Accipiter cooperii) during the non-breeding season (August–February) of 2012–2013 in Vancouver, British Columbia to assess the land use within their home ranges. We assessed fledging success during the 2012 and 2013 breeding seasons. Radio-telemetry confirmed that the Vancouver population is composed of year-round residents. The average home range assessed via a 95% fixed Kernel Density Estimate (KDE) was 4.71 ± 1.40 km2 (SD) and the core habitat, assessed via 50% KDE was 1.11 ± 0.33 km2. We used the home range value to evaluate land use surrounding Cooper's Hawks nests (n = 22). Most of the home range was covered by residential or commercial land-use (2.63 ± 1.28 km2) followed by recreational land use (0.75 ± 0.5 km2). Nests were built mainly in a variety of deciduous trees (72%) including London plane trees (Platanus orientalis x Platanus occidentalis), sweet gum (Liquidambar styraciflua) and black cottonwood (Populus trichocarpa). The majority of nests were in parks (63.6%), along heavily treed residential boulevards (22.7%) and next to golf courses (13.6%). During 2012 and 2013, 77% of nests produced young with fledging success of 2.21 chicks/nest (range 0-4 chicks/nest).

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**Fall Migration of Radio-tagged Broad-winged Hawks in California**

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Little is known about the occurrence and migration patterns of Broad-winged Hawks (Buteo platypterus) in the western United States. Annual fall migration of Broad-winged Hawks in California was documented at the Marin Headlands (near San Francisco) in 1972. Fall migration counts during 1986–2011 ranged from 25 to 248 sightings per season (mean 115 ± 64). The migration window was contained almost entirely from 8 September to 27 October,


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with a peak on 27 September. In 1994, we radio-tracked a juvenile Broad-winged Hawk from the Marin Headlands to the US-Mexico border, and then repeated the study in 2012. Based on straight-line distances travelled between roosts, the two hawks flew a minimum of 860 km during four full days of migration, each roosting just across the Mexico border in Baja California after the fourth day. Daily flight distances ranged from about 130 to 250 km, and daily migrations began 2.5 to 3 hr after sunrise. Nightly roost locations were remarkably aligned for the two birds. After spending their first nights near the release site in the Marin Headlands, both birds followed roughly similar flight paths south, spending their second through fifth nights at roost locations spaced just 5 to 40 km apart from each other (mean 25 km), within the same mountain ranges. Flight paths along mountain ranges and patterns of radio signals indicated that slope-soaring was a primary strategy. The similarities of flight paths, daily flight distances, and roost locations for these two migrations, 18 years apart, likely reflected certain innate behaviors (e.g., daily timing of migration) and long-term climate conditions (e.g., predominant northwest winds). Specific information on raptor pathways through central and southern California is critical given the current rapid development of large, renewable energy facilities and their potential for killing birds.

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**Relocation of a Bald Eagle (Haliaeetus leucocephalus) from a Nest in a Dead Tree Near Electric Distribution Power Lines in Houston, Texas U.S.A.**

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Bald Eagle populations have increased even as expanding human presence and activity near nesting sites has also increased. Bald Eagles have shown an ability to successfully nest in areas closer to human activity than initially described. Raptor nesting in urbanized areas can expose birds to anthropogenic risks including higher risk of interactions with power lines. Accordingly, CenterPoint Energy Houston Electric (CEHE) proactively tracks Bald Eagle nest sites within the CEHE service area as part of CEHE's Avian Protection Program. In July 2013, CEHE relocated a Bald Eagle nest near the San Jacinto River in Humble, Texas, part of the greater Houston metropolitan area. The nest was reported to CEHE in March 2012 in a dead pine tree overhanging electric distribution power lines in the front yard of a rural residence. With support from the U.S. Fish and Wildlife Service, CEHE relocated the nest away from distribution power line equipment to: 1) Prevent the nest tree from falling during the 2013–2014 nesting season when the nest would have been likely to contain eggs or young; 2) Reduce the risk of electrical contact with the power lines below; and 3) Support continued successful use of the nesting territory by the resident Bald Eagle pair. Power lines in the nesting area were also retrofitted to reduce avian electrocution risks. The Bald Eagle pair reared 2 offspring in a newly-constructed alternate nest in 2014, and as of May 2014, the fledglings were roosting in the relocated nest.

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**Use of Anthropogenic Nest Substrates by Crested Caracaras**

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Crested Caracaras (Caracara cheriway; "Caracaras") are unique among falcons in that Caracaras are the only Falconidae to construct their own nests. Caracaras have not previously been reported using anthropogenic nest substrates. Here we report five Caracara nests on anthropogenic substrates. 1) A nest on an A-frame lattice electrical transmission tower in a substation in Florida, U.S.A. The nest was 15 m above the ground, and contained two nestlings. 2) A nest on an A-frame lattice electrical transmission tower in a substation in Texas, U.S.A. The nest was 21 m above ground and contained two eggs. 3) A nest on a lattice electrical transmission tower in the middle of a 0.75 km wide open water ship channel in TX. The nest was 20 m above the surface of the water and contained 3 eggs. 4) A nest on the support structure of a billboard in, FL. The nest was 10 m above the ground. Nest contents could not be evaluated. 5) A nest on a radio tower in FL. The nest was on a maintenance walkway 20 m above the ground. Nest contents could not be evaluated. Caracara nests typically occur 4–8 m above ground. The nests we found were higher. Young Caracaras typically fledge prior to being well flighted, gliding to the ground where they hide under vegetation. Because we did not monitor nest success, we do not know whether higher nests allowed this behavior, or whether

nesting above open water might have impacted fledgling survival at the nest in the ship channel. We also do not know if Caracaras are expanding nesting to anthropogenic substrates due to habitat conversion in existing breeding territories, or if they are expanding by creating new territories when colonizing previously unoccupied human-dominated habitats.

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**Gyrfalcon (Falco rusticolus) Movements and Home Ranges on the Yukon-Kuskokwim Delta, Alaska**

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Tracking movements of raptors is essential for determining patterns in their use of space and habitat over time. Here, we describe the home ranges and post-fledging movements of adult and juvenile Gyrfalcons tracked with satellite telemetry on the Yukon-Kuskokwim Delta (YKD), AK 2004–2006. We used Geographic Information Systems (GIS) to analyze movements of two juvenile and two adult female Gyrfalcons. Home range estimates for the adults during the breeding and non-breeding season based on the minimum convex polygon, 95% fixed Kernel Density Estimate (KDE), and 50% fixed KDE varied from 26 to 939 km2 and 40 to 341 km2, respectively. Our results showed large areas of overlap in the adults' home ranges between seasons and individuals. Our estimates of adult home range size during the breeding season were similar to those estimated in Greenland, but estimates during the non-breeding season were much smaller in Alaska. Both juveniles exhibited dispersal events at approximately 118 d post-hatching, stayed within 200 km of their nest cliff until mortality (suspected) at approximately 191–222 d post-hatching, and showed a preference for coastal areas post-dispersal. These results suggest: 1) Gyrfalcons breeding on the YKD are non-migratory; 2) Adults use similar habitats and areas for the breeding and non-breeding seasons; and 3) Juvenile and adult Gyrfalcons utilize different post-breeding habitats on the YKD.

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**Rapid Diversification of Falcons (Aves: Falconidae) Due to Expansion of Open Habitats in the Late Miocene**

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Understanding how and why lineages diversify is central to understanding the origins of biological diversity. The avian family Falconidae (caracaras, forest-falcons, falcons) has an uneven distribution of species among multiple well-supported clades, and provides a useful system for testing hypotheses about diversification rate and correlation with environmental changes. We analyzed ten independent loci for 1 to 7 individuals from each of the 64 currently recognized Falconidae species, together with two fossil falconid temporal calibrations, to assess phylogeny, absolute divergence times and potential shifts in diversification rate. Our analyses supported similar diversification ages in the Early to Middle Miocene for the three traditional subfamilies, Herpetotherinae, Polyborinae and Falconinae. We estimated that divergences within subfamily Falconinae began about 16 million years ago (mya) and divergences within the most species-rich genus, Falco, including about 60% of all Falconidae species, began about 7.5 mya. We found evidence for a significant increase in diversification rate at the basal phylogenetic node for genus Falco, and the timing for this rate shift correlates generally with expansion of C4 grasslands beginning around the Miocene/Pliocene transition. Concomitantly, Falco lineages that are distributed primarily in grassland or savannah habitats, as opposed to woodlands, and exhibit migratory, as opposed to sedentary, behavior experienced a higher diversification rate.

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**Diet and Roost Tree Characteristics of a Long-Eared Owl (Asio otus) Winter Roost Location in Pennsylvania: An Opportunity for Undergraduate Raptor Research**

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Populations of Long-eared Owls have been declining

throughout the United States. In Pennsylvania, their population decline resulted in their listing as a state-threatened species in 2012. As part of undergraduate research projects, four undergraduate students collected, compiled, and analyzed Long-eared Owl pellets and habitat data during the winters of 2011, 2012, and 2013. A fifth student compiled and analyzed the data this past academic year. Pellet analysis (n = 131) indicated prey selection varied significantly by year. Prey selection was dominated by meadow voles (Microtus pennsylvanicus) annually, but years with substantial snow cover influenced the selection of other food sources such as short-tailed shrew (Blarina brevicauda), white-footed mouse (Peromyscus leucopus), and Northern Cardinal (Cardinalis cardinalis). The presence of these three prey species increased in pellets during years with snow cover, potentially due to reduced availability of meadow voles under the protective cover of snow. Long-eared Owls appear to have plasticity regarding prey selection based on local weather variability. Long-eared Owls used a limited number of roost trees in the white pine (Pinus strobus) dominated grove we studied. We used habitat data to compare roost trees to those of the surrounding woodlot. The owls selected white pine trees that had multiple main stems disproportionate from availability. The added complexity of multiple main stems appears to be important component of roost tree selection and may be a limiting component to high quality winter roost habitat.

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**Movement Rates of Swainson's Hawks from the Plains of Texas to the Pampas of Argentina**

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Swainson's Hawks (Buteo swainsoni) breed across the prairie grasslands of North America and are of conservation concern in many states. The population migrates en masse from North America each autumn to wintering grounds in the Pampas of Argentina. With a round trip migration that may exceed 22,000 km, this is one of the longest migrations known for birds of prey. Previous studies have utilized satellite telemetry to identify wintering grounds and investigate migratory pathways and movements of Swainson's Hawks. However, many relevant ecological questions remain regarding the migration ecology of the species. Starting in 2012, we began attaching GPS Platform Transmitter Terminals (PTTs) to male and female Swainson's Hawks nesting in the panhandle of Texas. Our goal was to investigate their year-round ecology. These PTTs provide 6–8 latitude and longitude coordinates with 18 min accuracy, speed, heading, and altitude data on a daily basis. We used these data to assess gender-specific movement rates and routes of 24 individual Swainson's Hawks during two autumnal migrations and two spring migrations. Overall, fall migration for Swainson's Hawks took an average of 50 days with a mean distance traveled of 10,474 km. Mean day of departure on fall migration was October 5 in 2012 and September 24 in 2013. Spring migration for Swainson's Hawks took an average of 48 days and mean distance traveled was 10,540 km. Mean day of departure on spring migration was March 3 in 2013 and March 7 in 2014. Migration routes were consistent for Swainson's Hawks in all years, and we were able to identify potentially important areas for conservation efforts.

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**A Specialist in the City: The Hunting Behavior and Diet of Barn Owls (Tyto alba) Along a Rural to Urban Gradient**

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Barn Owls in western British Columbia Canada will soon be designated a "threatened" species. The main stressors are the loss of grassland habitat due to urban development, changing agricultural practices, and road mortality. Barn Owls are also increasingly exposed to second generation anticoagulant rodenticides (SGARs). We know very little about the exposure pathways and potential sub-lethal and population level effects of SGARs. We conducted a radio telemetry and diet study to better understand the potential ecotoxicological pathways responsible for the high SGAR exposure documented in Barn Owls. We studied 10 Barn Owls through radio-tagging and monitoring for up to a year, and through collection of pellets from the owls' nest or roost sites on a bi-monthly basis. The 95% Kernel Density Estimates (KDE) home range sizes varied greatly (range 0.6–28.56 km$^2$) between individuals, and home range sizes were positively correlated with the amount of urban development within home ranges, but the relationship was


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non-significant (t = 0.41, P = 0.11). Consumption of rats increased significantly with the amount of urbanization found within home ranges (t = 0.46, P < 0.05, $R^2$ = 0.21), but voles (primarily field voles, Microtus towsendii) were the main prey item for all sites irrespective of land use within home ranges. Our radio telemetry data indicated Barn Owls selectively choose grass habitat for hunting, and even in highly urban landscapes, they focused hunting on isolated undeveloped grass patches and linear strips, often in close proximity to permanent bait stations containing SGARs. This, combined with the increased consumption of rats in more urban environments may explain the substantial and rising SGAR exposure rate in Barn Owls.

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**The Distribution of Potential Northern Aplomado Falcon (Falco femoralis septentrionalis) Habitat in Mexico**

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Despite the Endangered status of the so-called Northern Aplomado Falcon, its status and distribution has not been well documented. Since the 19th Century, Aplomado Falcons have been regularly encountered in the tropical lowlands of eastern and southern Mexico, and this region is still the stronghold of this species in the northern hemisphere. Elsewhere in Mexico, lack of historical records and systematic surveys reduce our ability to know much of past or current distribution and status. This presentation uses locality records and classification of aerial photography to estimate the spatial distribution of plant communities known to be inhabited by Aplomado Falcons. This analysis indicates most tropical lowland habitat is in cattle pastures in Campeche, Chiapas, east San Luis Potosi, Tabasco, south Tamaulipas, and Veracruz. This habitat has mostly been created by clearing forests and woodlands at the expense of forest biodiversity. This process has also created habitat on the Yucatan Peninsula and on the west coast in Chiapas, Guerrero, Oaxaca, and adjacent parts of Guatemala. Creation of tropical habitat by deforestation has increased habitat for Aplomado Falcons, but has been offset somewhat by conversion of ranchland to croplands. On the central plateau of Mexico, scattered patches of potential habitat in desert grassland also exist in portions of Chihuahua, Coahuila, Durango, west San Luis Potosi, and Zacatecas. Most of these patches have never been intensively surveyed for Aplomado Falcons and are currently threatened by expansion of farming and desertification.

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**Water Limitation and Gray Hawk Diet on the San Pedro River**

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The Gray Hawk (Buteo plagiatus) is a neotropical buteo whose range extends from Central America into the southern edge of the southwestern United States. Their population along Arizona's San Pedro River has been expanding since the 1980s, and has reached a density of 2 nests per river kilometer in some places. Proximity to groundwater varies along the river's length, and during the dry season, stretches can be dry, intermittent, or wet. Gray Hawk diet and foraging habitat have been little studied, and this research is the first to focus on the relationship between water availability and prey selection. We hypothesize that diet will be more specialized in wet stretches because prey will not be water limited, and high prey abundance will allow Gray Hawks to exploit a preferred resource. During a pilot study in the 2014 breeding season, we located 30 nests over 30 river kilometers and observed that though whiptails (Cnemidophorus species) and Clark's spiny lizards (Sceloporus clarkii) were the dominant prey species, some pairs in areas with intermittent groundwater specialized in small mammals. Apparent nest success was 60%, with approximately one chick fledged per nest. Although observed nest density was higher than has been documented in recent studies, nest success appeared to be lower. These preliminary data lead us to further questions about the interaction between groundwater, habitat quality, prey selection, and productivity.

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**Habitat Characteristics and Nesting Success of the Western Burrowing Owl (Athene cunicularia) in a Suburban Desert Landscape**

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Burrowing Owls are a species of conservation concern

across the western U.S. In Lake Havasu City, Arizona, Burrowing Owls are commonly observed in nontraditional habitats such as desert arroyos (washes) in developed locations. Suburban washes may offer a large prey base and abundant existing burrows. However, owls are susceptible to disturbance from humans and vulnerable to predation by domestic dogs and coyotes. We began examining habitat preference and reproductive success of Burrowing Owls in August 2013 by identifying 46 active burrows. We recorded habitat characteristics, burrow size and height, wash slope and substrate, percent cover and type of vegetation, human activity, and checked burrows monthly for activity. We identified prey availability through arthropod pitfall traps, small mammal trapping, and pellet analysis. We used remote cameras to confirm predator presence, mated pairs, and chicks fledged. Our study area falls between year round resident populations in southern Arizona and migratory populations to the north. Preliminary results indicate that 30% of our sample is migratory. Desert Pocket mice (Chaetodipus penicillatus) and Tenebrionid beetles are owls preferred prey and are abundant in our suburban habitat. Of washes hosting owls, 83% also hosted coyotes. We have monitored 28 burrows since the beginning of this breeding season. We found mortalities due to coyotes (n = 2), illness-induced starvation (n = 1) and suspected consumption of poisoned prey (n = 6). Fifteen of the remaining burrows host mated pairs currently incubating eggs or caring for chicks. Burrow and site characteristics, prey availability, and predator activity will be considered as possible predictors of nest success. To date, there have been no similar studies in suburban locations of the southwest. Our research over the next two nesting seasons will provide baseline data on the local population and help biologists and managers understand habitat preferences of suburban Burrowing Owls.

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**The American Eagle Foundation Eagle Grants Will Award About $100,000 for Bald Eagle (Haliaeetus leucocephalus) Conservation Work in 2015**

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The American Eagle Foundation (AEF) accepts grant proposals between July 1 and September 1 for work to be carried out the following year (provided funding is available). AEF obtained funding for this grants program in 2004, when the U.S. Senate and House unanimously passed the Bald Eagle Commemorative Coin Act. Congress authorized the U.S. Mint to mint gold, silver, and clad coins, for sale to the public. AEF continues to make those coins available via the AEF web site. Sales from the U.S. Mint generated $7.8 million in 2004, which Congress designated that AEF utilize for the benefit of Bald Eagles (Haliaeetus leucocephalus). AEF set aside 75% of these funds, or approximately $5.8 million, to perpetually grow the American Eagle Fund to provide competitive annual grants for Bald Eagle projects. AEF utilizes a Bald Eagle Grant Advisory Team to numerically rate all grant applications. This team consists of some of the Nation's most outstanding eagle experts. For 2014, eight projects were awarded grants totaling $99,986. Locations ranged from Arizona to Maine, and project scopes ranged from nest site protection to telemetry tagging. Additional information may be found at www.eagles.org/grants or by contacting Jody Millar, AEF Grants Coordinator at eaglegrants@gmail.com. The AEF appreciates receiving pre-proposals so that we may provide assistance with project development, and/or gain awareness of the variety of projects to be submitted.

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**Does Annual Home Range Size Decrease with Age among Female Cooper's Hawks (Accipiter cooperii)?**

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We used 95% kernel density estimators to quantify annual home range for 21 known-age, radio-tagged female Cooper's Hawks. Ten of these hawks were tracked for > 2 yr, yielding a total of 32 annual home range size estimates. Annual home ranges of 11 age 0–1 (first yr) female Cooper's Hawks averaged 939 km2, home ranges of 11 age 1–2 (second yr) female Cooper's Hawks averaged 141 km2, home ranges of five age 2–3 (third yr) female Cooper's Hawks averaged 17 km2, home ranges of two age 3–4 (fourth yr) female Cooper's Hawks averaged 7 km2, and home ranges of two age 4–5 (fifth yr) Cooper's Hawks averaged 3.8 km2. The trend for home range size to decrease with age, at least over the first 5 yr of life, was evident in the overall sample, and among individual Cooper's Hawks tracked for > 2 yr. All but one of the female Cooper's Hawks we studied acquired a breeding territory and attempted


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nesting in her first year of life. These are preliminary findings from what will be a long-term study, thus these results may change with more data. However, our primary analysis suggests female Cooper's Hawk home range sizes decreases with age, particularly after the second year of life.

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**Creation of a National Eagle Roost Registry**

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Communal roosts play an important role in the life cycle of non-breeding eagles and are specifically protected in the "disturb" clause of the Bald and Golden Eagle Protection Act. State and federal regulatory agencies are currently unable to adequately protect eagle roosts because of a lack of information on roost locations and roost usage. We created a National Eagle Roost Registry to address this information gap critical for protecting non-breeding eagles. The registry provides information needed by agencies to enforce the National Bald Eagle (Haliaeetus leucocephalus) Management Guidelines. We delineated communal roosts using satellite transmitter data from 137 Bald Eagles in the Atlantic flyway. Over 300 communal roosts were identified with GIS analysis. We collected historic and active roost locations from knowledgeable land managers and biologists and will continue to seek additional roosts to add to the registry. The National Eagle Roost Registry is available online and roosts are displayed on a google map base layer.

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**Habitat Selection and Food Habits of three Species of Raptors (Aquila chrysaetus, Nisaetus nipalensis, and Accipiter gentilis) in Japan**

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Golden Eagles in Japan inhabit steep mountainous terrain 1000–3000 m above sea level (asl). Nests occur primarily on cliffs, and rarely on trees. Almost 50% of the diet of Golden Eagles in Japan consists of mammals, including Lepus brachyurus, Martes melampus, and Cervus nippon. Birds constitute 30% of the diet of Golden Eagles, with prey species including Symaticus Soemmerringii, and Garrulus glandarius. The rest of the diet includes reptiles like Elaphe climacophora, E. quadrivirgata, and Gloydius blomhoffii. Fawns are frequently delivered to nestlings throughout the breeding season. Mountain Hawk-eagles are distributed in the dense mountain forest zone 300–1500 m asl. Mountain Hawk-eagles nest in trees and typically lay one egg every other year. The diet of this species includes 60% reptiles, 20% mammals, such as Nyctereutes procyonoides, Meles meles, Vulpes vulpes, and Scirus lis, and 16% birds, including Garrulus glandarius, A. gentilis, and Strix uralensis). Goshawks inhabit lowland forests surrounded by farmland and paddy fields. Goshawks prey primarily on birds, including Columba livia, Sturnus cineraceus, and Hypsipetes amaurotis.

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**Transmitter Influences on Raptor Agility and Avian Prey Selection**

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Remote sensing technology (i.e., VHF radios, GPS transponders, etc.) has become an important tool in wildlife research. These tools, however useful, require that an animal carry a foreign structure on its body for a period of time. In the case of volant species, the weight, shape, and attachment method of the transmitters must be managed so as to permit flight. We use trained raptors to assess influences of weight loading on agility as a metric for ability to capture prey, and to investigate the influence of transmitters on prey selection. We conducted trials to measure the influence of transmitter weight loading on speed and agility of a Red-tailed Hawk (Buteo jamaicensis). Our initial data are limited and do not meet the assumptions for analysis, however we observed no apparent difference in Red-tailed Hawk flight speed or wing beat frequency among transmitter loadings of 0, 2.5, and 5% body weight. We used a Northern Goshawk (Accipiter gentilis) and an American Kestrel (Falco sparverius) to assess their selection between radio-tagged and unencumbered prey birds. The Northern Goshawk selected transmittered Northern Bobwhite (Colinus virginianus) over unencumbered individuals in 14 (67%) of 21 paired flights. The American Kestrel selected transmittered House Sparrows (Passer domesticus) over unencumbered individuals in 4 (57%) of 7 paired flights. Our data and results are preliminary, but suggest raptors may select radio-transmittered individuals over

unencumbered prey. We intend to collect another season of data and to include measurements of turning performance for raptor agility. Additional prey selection trials will add to our data set and may more clearly reveal whether or not radio-transmitters influence prey selection.

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**Nest and Nest-Site Characteristics and Prey of Solitary Eagles (Buteogallus solitarius)**

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The Solitary Eagle (Buteogallus solitarius) is poorly known to the scientific community in all aspects of its ecology. It is local and exceptionally rare throughout its range from northern Mexico to northern Argentina and is restricted to steep mountainous and hilly terrain. Prior to our research, only three nests (2 in Mexico and 1 in Peru) of the Solitary Eagle had been documented and none of those nests were studied. Here we describe two Solitary Eagle nests. One was discovered 30 June 2011 in a Pinus oocarpa tree in the sub-montane pine forest in the Mountain Pine Ridge region of Belize. The nest fledged a single young in 2011. The other nest was discovered on 7 January 2010 in montane desert-scrub on a rock outcropping in the Loja Province in Ecuador. We do not know if the pair used the nest or departed the area after its discovery, as the nest was not observed again until 26 June 2012, when no birds were observed. We also describe breeding activity from two additional locations in Belize, where dependent juveniles and adults were observed in 2011 and 2012. During the nestling period of the Belize nests, we observed twenty prey deliveries to the nestling. Seventeen of the twenty (85%) prey items were snakes, and the other three were a Nine-banded Armadillo (Dasypus novemcinctus), Striped Basalisk (Basiliscus vittatus), and an unidentified rat. Adults delivered prey to the nestling 1–3 times per day between 09:26 and 17:52. This information provides the first detailed description of the Solitary Eagle nest and nest-site characteristics, as well as the first study of its diet.

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**Relationships Between Prey Abundance and Barn Owl-Vehicle Collisions Along U.S. Interstate Highway 84 in Southern Idaho**

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Roadway collisions directly kill billions of animals each year and affect many vertebrate and invertebrate taxa. Among birds, vehicular collision rates are particularly high for Barn Owls (Tyto alba). One of the world's highest roadway mortality rates for Barn Owls occurs along Interstate Highway 84 (I-84) in southern Idaho. The primary prey items of Barn Owls are small mammals, and owls may be colliding with oncoming traffic while hunting along the highway. There are several zones along the I-84 corridor where Barn Owls are killed in much higher numbers. Little is known about small mammal abundance along the I-84 corridor, so it is unclear if Barn Owl mortality is higher in areas with high prey abundance or if prey is equally abundant in low Barn Owl mortality areas. Equal prey abundance may point to other causal factors, such as roadway features, that influence Barn Owl mortality. Our objectives were to model small mammal abundance, and based on model predictions, spatially project small mammal abundance along I-84 to compare with Barn Owl mortality locations collected between 2005 and 2014. We used a combination of track and camera traps to survey small mammals during winter and summer at over 120 locations along the I-84 corridor. We modeled small mammal occurrence in relation to roadway, land cover, spatial, and anthropogenic features. We also sought to determine if areas with the highest small mammal abundance correlated with areas of high Barn Owl mortality. Our results will help guide future mitigation efforts to reduce Barn Owl roadway mortality.

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**Assessment of Road Proximity, Land Use, and Power Transmission Lines on Characteristics of Predator and Scavenger Visits to Burrowing Owl Nests in the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA), Idaho**

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Burrowing Owls (Athene cunicularia) nest in subterranean burrows typically dug by other animals. Because they nest below the ground, and their flightless nestlings spend time on the ground outside of their nest burrows, Burrowing Owls are susceptible to predation by a suite of mammalian, avian, and reptilian predators. Land use, proximity to roads, and the presence of power transmission lines may alter the composition of potential predators and thus the likelihood of nest predation. We investigated the potential effects of these factors on rates of predator visits to Burrowing Owls nests and their outcomes in the NCA, Idaho. During 2012–2014 we used motion-triggered infrared trail cameras placed at more than 45 Burrowing Owl nests in both natural and artificial burrows to record the timing, frequency, duration, inter-visit interval, and outcome of predator and scavenger visits. We obtained and analyzed more than 300,000 camera images. The most frequent visitors to Burrowing Owl nests were coyotes (Canis latrans), badgers (Taxidea taxus), Common Ravens (Corvus corax), Ferruginous Hawks (Buteo regalis), and Prairie Falcons (Falco mexicanus). Common Ravens were recurrent scavengers of prey remains at entrances to owl nests. However, we also recorded for the first apparent instances of predation by Common Ravens on Burrowing Owl nestlings. We discuss these results in relation to land use change within the NCA.

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**Modeling Occupancy of Barn Owls in Southern Idaho, U.S.A. in Relation to Roadway Mortality**

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Barn Owls (Tyto alba) are frequent victims of roadway mortality. They are killed in greater numbers along roads than any other North American bird of prey. Interstate Highway 84 (I-84) in southern Idaho has among the world's highest rates of Barn Owl-vehicle collisions. Juveniles and females are killed most often, and mortality typically peaks in winter. There are sections of I-84 where Barn Owls are killed in extraordinary numbers and others where few die. Because nothing is known about patterns of Barn Owl occupancy in this region, it is unclear if owls are simply killed in proportion to their abundance, or if they are equally abundant in segments with lower mortality. The latter would provide potential clues to roadway features or other factors that protect owls from vehicle collisions. We were interested in modeling Barn Owl occupancy, and using model-based results from occupancy models to spatially project the probability of Barn Owl occurrence along the interstate to compare with actual Barn Owl mortality locations. During winter 2014 we surveyed for owls at 253 randomly selected point count locations (three times each, 759 total surveys) along a 300-km stretch of I-84. These points occurred within distance bands that ranged from 0–3, 3–7, and 7–17 km from the focal interstate. Each point count included silent listening followed by broadcast of Barn Owl vocalizations, with spotlighting to aid visual detection. We used an occupancy modeling framework to assess weather, spatial, land cover, and anthropogenic features that influenced Barn Owl occupancy or detection at the local and landscape level. To inform potential mitigation approaches, we also determined whether Barn Owl mortality occurred in proportion to estimated occupancy.

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**Motion-Activated Cameras to study Cliff Nesting Raptors: New Installation Methods, With Tips to Reduce Cost and Disturbance**

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Cameras are one method used to monitor nesting raptors. Until recent technological advancements, logistical challenges of camera maintenance in remote study areas have limited the application of this method. Additionally, installation procedures have involved long periods at nest sites, increasing human disturbance. We present new methods for installing nest cameras to monitor cliff nesting raptors with descriptions for attaching cameras to cliffs and considerations for proper camera placement and programming and reducing disturbance. We placed 10 motion-activated cameras near occupied Gyrfalcon (Falco rusticolus) nests in western Alaska to monitor prey deliveries during the nestling period. Camera technology allowed us to visit nests only once after installation to switch memory cards and batteries, thus reducing logistical challenges and limiting nest disturbance. This new, relatively low cost equipment and installation procedure limits installation time, in turn decreasing nest disturbance and increasing success of research objectives.

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**Observations of a Juvenile Red-tailed Hawk (Buteo jamaicensis) Preying on Western Diamondback Rattlesnakes (Crotalus atrox)**

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While there are many reports of Red-tailed Hawks and other raptors being killed by venomous snakes, there are few reports of raptors preying on rattlesnakes. Here, we report observations of a juvenile Red-tailed Hawk preying on two adult western diamondback rattlesnakes. The hawk, a falconry bird, captured, killed, and ate a rattlesnake in Cornville, Arizona, U.S.A. in February, 2014 and again in March, 2014. On February 16th, we observed the hawk stoop, and when we arrived at the site, the hawk had the snake's head in one foot, and the upper third of the snake's body in the other foot. The hawk was bitten, and presumably envenomed, in a toe on the left foot. Despite the injury, the hawk ate the rattlesnake, starting with the head, including venom glands, and then the body. The hawk received treatment with dexamethasone and fluids, and subsequently recovered. On March 23rd, the same hawk caught a second rattlesnake at the same location. This time the hawk glided more slowly to the ground and spread its wings over the snake. The snake struck at the bird but missed. The hawk then secured the snake's head in its talons. The hawk had once again been bitten, this time in its left hallux. We removed the hawk before it could consume more than a small portion of the snake's head, and we provided the same treatment as before. The hawk again recovered. Our observations suggest that Red-tailed Hawks, even juveniles, will at least occasionally attempt to prey on large rattlesnakes.

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**Northern Goshawk (Accipiter gentilis) Genetic Diversity and Connectivity Among the Naturally Fragmented Forests of the Northern Great Basin, U.S.A.**

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Forest fragmentation, natural or man-made, places limits on the movement of individuals, populations, and species. Even highly mobile species, such as birds, often fail to disperse across highly fragmented landscapes. The constrained movement of species may lead to reproductive isolation, inbreeding depression, and could possibly contribute to speciation. The naturally fragmented forests of the northern Great Basin are home to a number of unique species and populations, which are thought to have resulted from the fragmented nature of the forest, including unique plant species (Christ's paintbrush, Castilleja christii), and populations (Rocky Mountain lodgepole pine, Pinus contorta latifolia), and a unique avian subspecies (South Hills Crossbill, Loxia curvirostra sinesciuris). Likewise, other species occupying these forests may possess unique genetic diversity or show signs of inbreeding depression. The Northern Goshawk, a species which occupies many of these forest fragments, has shown low levels of integration between geographically dispersed populations elsewhere in its range. We set forth to evaluate the genetic diversity of the Northern Goshawk population occupying the northern Great Basin, by searching for signs of inbreeding depression, estimating effective population size, and placing the population in biogeographical context of other


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western populations. We used blood samples gathered from nestlings and molted feathers from adult birds from four separate forest islands in south-central Idaho. We used microsatellite loci to compare genetics among individuals with, and used mitochondrial DNA sequences to place these individuals in a biogeographic context. Our work provides an import foundation for understanding genetic ecology of goshawks within the northern Great Basin, and establishes the degree of genetic health and integration of birds in this landscape as compared to other populations.

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**The Ecological Role, Foraging Behavior, and Economic Importance of Barn Owls to Human Communities of Kainji Lake National Park, Nigeria**

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We investigated the ecological role, foraging behavior and economic importance of Barn Owls (Tyto alba) inhabiting Kainji Lake National Park, Nigeria. We used a questionnaire to gather responses on the importance of Barn Owls to members of communities neighboring Kainji Lake National Park. Our questionnaires invited respondents to provide information on abundance, activity, distribution, and foraging behavior of Barn Owls throughout the area. Respondents indicated their perceptions that Barn Owls limit rodent and pest populations, thus providing ecological services by reducing the impact pest populations have on local agriculture. Respondents also indicated declines in Barn Owl populations correlated with habitat modification due to rapid human development around Kainji Lake National Park. In response, a nest box installation program has been implemented by local farmers to support the conservation of Barn Owls in the area.

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**Integrating Nutritional Ecology, Endocrine Ecophysiology, Ecoimmunology and Geospatial Ecology in Migration Studies**

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Diverse biomarkers including stable isotopes, hormonal profiles, and ecoimmunological profiles are commonly used to assess animal condition, but a growing recognition finds that an integrative approach is necessary to contextualize and understand a biomarker's relevance to animal health in varied ecological conditions. The aim of this study was to illustrate how integration of existing methods and biomarkers assayed on differing fractions of tissues can provide a wealth of knowledge about animal health and ecology across time and space. We used integrated measures of glucocorticoids, stable isotopes, and parasite loads in feathers and blood of fall migrating Northern Saw-whet Owls (Aegolius acadicus) to estimate breeding locations, and energetic workload during the periods of breeding and migration. In feathers we assayed deuterium (δD) isotope and corticosterone (CORT) profiles. In blood we measured CORT and blood parasite levels. We found that owls migrating earlier had elevated CORT levels relative to owls migrating later. We did not find associations between plasma and feather CORT, or blood parasite loads. These results illustrate the role that CORT plays in mediating preparation for and timing of migration, and how these tissues integrate time periods from weeks to seasons reflecting energetic demands during differing life stages. These results illustrate the potential for integrating diverse biomarkers to assess interactions between environmental factors and animal health across varied time periods without the necessity of continually recapturing and tracking individuals. Biomarkers from research fields including stable isotope ecology, endocrine ecophysiology, nutritional ecology and ecoimmunology are becoming more readily available and accessible. When combined into an integrated framework, these techniques hold great promise for advancing our understanding of environmental effects on animal health.

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**Effect of Variation in Nestling Hunger Levels on the Begging Behavior of Nestlings and the Provisioning Behavior of Adult American Kestrels**

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Little is known about how variation in nestling begging intensity affects the behavior of adult raptors or how


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responses of adult males and females to such variation might differ. Our objective was to manipulate the begging intensity of nestling American Kestrels (Falco sparverius) and examine the responses of adult males and females. To evaluate this, we studied pairs of kestrels (N = 12) from 1 May–1 July 2014 in Madison County, Kentucky. Nest boxes had a separate compartment for a camcorder so nestling and adult behavior could be monitored. To manipulate nestling hunger levels, we fed nestlings in six nests until satiated, and nestlings in the other six nests were deprived of food. We video-recorded begging behavior of nestlings 14–24 days old and provisioning behavior of adults prior to (control) and after treatments. Prior to treatment, provisioning rates of adult kestrels did not differ between treatments ($F_{1, 20} = 0.2$, $p = 0.69$), and adult males and females provisioned at similar rates ($F_{1, 20} = 0.3$, $p = 0.62$). After treatment, provisioning rates of adult kestrels with fed versus food-deprived nestlings differed significantly ($F_{1, 20} = 28.3$, $p < 0.0001$), with food-deprived nestlings fed at more than three times the rate (mean = 3.8 provisioning trips/hour) of fed nestlings (mean = 1.2 provisioning trips/hour). Adult males and females provisioned at similar rates after treatment ($F_{1, 20} = 1.7$, $p = 0.20$). Our results suggest that the begging behavior of nestling American Kestrels varies with hunger level and that adults alter their provisioning rates accordingly. As previously reported in studies of songbirds, begging by nestling American Kestrels appears to represent an honest signal of need to which both adult males and females respond by adjusting provisioning rates.

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**Is Sunbathing by Burrowing Owls a Response to Ectoparasite Infestation?**

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Burrowing Owls (Athene cunicularia) and their nests harbor at least 39 different species of arthropods from 21 different families. Some of these arthropods are ectoparasites on adult and young Burrowing Owls. Among the common ectoparasites on Burrowing Owls are fleas. These fleas are primarily Pulex irritans (Family Pulicidae), the human flea. New evidence suggests that these fleas actively feed on Burrowing Owls, rather than occurring on simply by accident or using owls solely as phoretic hosts. Fleas can number in the hundreds within nests or on individual Burrowing Owls. Thus, we hypothesized that flea infestation shapes Burrowing Owl behavior to avoid costs of ectoparasites or the discomfort that fleas present. As part of another experiment using motion-activated trail cameras deployed at Burrowing Owl nests in southern Idaho during 2012–2013, we noticed instances of apparent sunning behavior in adult and nestling Burrowing Owls. Camera images revealed Burrowing Owls lying on the ground with wings outstretched and flat. We only observed this behavior during daylight hours, although cameras were active for 24 h/day. Sunbathing in birds is often associated with ectoparasite reduction although, to our knowledge, sunning has not previously been examined in relation to flea infestation. Thus, during 2014 we initiated an experiment to document the incidence and rate of sunbathing in Burrowing Owls in relation to ectoparasite infestation. We fumigated treatment nests with insecticide capable of removing fleas and other ectoparasites and used motion-activated trail cameras at over 25 nests to examine the hypothesis that sunbathing would occur more frequently in control nests where ectoparasites remained. Our poster summarizes results of these experiments and discusses implications for the evolution of Burrowing Owl behavior.


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