



PROGRAM and ABSTRACTS
Raptor Research Foundation
2005 Annual Meeting

hosted by

The Cofrin Center for Biodiversity
University of Wisconsin – Green Bay

Wisconsin Society for Ornithology

Neville Public Museum

Bay Area Bird Club

Regency Suites/KI Convention Center
GREEN BAY, WISCONSIN
12-16 October, 2005



Cofrin Center for Biodiversity
UNIVERSITY of WISCONSIN – GREEN BAY

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MEETING AT A GLANCE

RRF Board Meeting

Wednesday, October 12
8:00 am - 5:00 pm
Meeting Room 7

RRF Business Meeting – All RRF Members

Saturday, October 14
10:15 am – 12:00 pm
Ballroom A, Room 4

Program

Wednesday, October 12

5:00 – 9:00 pm
Convention Center Lobby South Registration
6:00 – 9:00 pm, East Atrium Opening Reception

Thursday, October 13

7:30 am - 5:00 pm
Convention Center Lobby South Registration
8:30 - 9:30 am
Ballroom A, Room 3 Welcome and Keynote Address
10:00 - 5:00 pm
Ballroom A, Rooms 1 and 2 Paper Sessions
5:30 – 8:30 pm
Conference Center Lobby Poster Session

Friday, October 14

7:30 am - 5:00 pm
Convention Center Lobby South Registration
8:00 am – 6:00 pm
Conference Center Lobby Poster Viewing
8:00 am - 5:00 pm
Ballroom A, Rooms 1 and 2 Paper Sessions
6:00 – 9:00 pm
University of Wisconsin Barbeque

Saturday, October 15

7:30 - 10:00 am
Convention Center Lobby South Registration
8:00 am – 12:00 pm
Conference Center Lobby Poster Viewing
10:15 am – 12:00 pm
Ballroom A, Room 4 RRF Business Meeting
1:00 – 3:00 pm
Meeting Room 5B Informal Workshop on the American Kestrel
3:20 pm - 5:30 pm
Ballroom A Paper Sessions

Social Events

Wednesday, October 12

6:00 – 9:00 pm, East Atrium

Opening Reception - Cash bar and hors d'oeuvres.

Thursday, October 13

5:30 – 8:30 pm

Conference Center Lobby

Poster Session - Cash bar and hors d'oeuvres.

Friday, October 14

6:00 – 9:00 pm

University of Wisconsin,
Green Bay, Cofrin Center
for Biodiversity

Barbeque with presentation by Alberto Pelleroni

Saturday, October 15

6:00 – 11:00 pm

Ballroom B, Room 1

Awards Banquet

Field Trips

Thursday, October 13

6:30 pm – 12:45 am

**Northern Saw-whet Owl Banding at Linwood Springs
Research Station – Stevens Point, WI**

LSRS bands 400-700 SWO each fall, and mid-October is peak migration. Experience banding, marking, age and gender determination and ratio, migration routes, infrared cameras to see owls netted and photo opportunity with SWO. The trip will leave the KI Center at 6:30 pm, arrive at LSRS around 8:45 pm and leave at 10:30 pm, and arrive back at the KI Center at around 12:45 am. Restroom/refreshment stop just prior to arrival and shortly after departure from LSRS. Cost: \$25/person, includes transportation and entrance fee. Minimum of 20, maximum of 25 participants.

Sunday, October 16

8:00 – 11:00 am

**Falconry Demonstration, UWGB Camp/Cofrin
Arboretum**

Experience two Harris' Hawks hunting rabbits cooperatively, a Red-tail Hawk hunting rabbits or squirrels, and possibly a Northern Goshawk hunting pheasants, rabbits, or pigeons. Weather permitting – will be cancelled if it is raining. Cost: \$5.00 (free if you drive yourself). Minimum of 20, maximum of 46 participants.

Sunday, October 16

8:00 am – 5:00 pm

Lakeshore Hawk Migration

At this time of year, with the right winds, the Lake Michigan shoreline, Ozaukee County, Harrington Beach State Park and Concordia University offer excellent hawk watching. Leave KI

Center at 8:00 am, arrive Ozaukee County at 10:00 am and leave at 3:00 pm. Arrive back at KI Center by 5:00 pm. Restrooms at park and university, lunch and drink provided. Weather permitting – will be cancelled if raining. Cost: \$35/person, including transportation and box lunch. Minimum of 20, maximum of 46 participants.

Sunday, October 16
Noon – 11:30 pm

International Crane Foundation and Northern Saw-whet Owl Banding at Linwood Springs Research Station

This visit to the International Crane Foundation (ICF) in Baraboo, WI, will include a half-hour multi-media presentation followed by a 1.5 hour guided tour of live exhibits of the world's 15 crane species. The ICF collection of captive cranes is used for captive breeding and reintroductions worldwide. Learn about ICF efforts to save these magnificent birds and see them up close in an outdoor setting. See <http://www.savingcranes.org>. (See Saw-whet Owl trip description at beginning of this section.)

Leave the Regency Suites/KI Center at 12 noon (please eat lunch before the trip). Arrive at ICF at 2:45 pm and leave at 5:45 pm. Arrive LSRS at 7:30 pm (dinner provided, eaten en route to LSRS). Leave LSRS at 9:30 pm, arrive back at KI Center at 11:30 pm. Because of the late return, be sure to have hotel/motel reservations for Sunday night if you go on this trip. Cost: \$53/person, including entrance fees, box lunch, and transportation. Minimum of 20 and maximum of 35 participants.

Field Trip Cancellation policy: Your entire fee will be refunded if the trip is cancelled for any reason by the Raptor Research Foundation. We will cancel trips if fewer than 20 people are registered.

GENERAL INFORMATION

Green Bay and the Surrounding Area

Established in 1634 on the shores of the world's largest freshwater estuary, Green Bay is the oldest settlement in the Midwest. More than 226,000 people live in the city, consistently ranked as one of the safest and most family-friendly communities in the nation. Today, Peregrines and Bald Eagles nest within the city limits, and an hour's drive brings visitors to the Chequamegon-Nicolet National Forest, extensive state and county forests, the famous west shore wetlands of Green Bay, and scenic tourist towns on the Door Peninsula and Lake Michigan shoreline.

Fall raptor migration in the Great Lakes region is in full swing during October, highlighted by huge numbers of Saw-whet Owls and other forest species. The glacial derived landscape of northeastern Wisconsin provides many rewarding opportunities for birdwatching, biking, and exploring, some located only a few miles from the Convention Center. Cultural experiences and historical exhibits are available, too, including the Weidner Center for Performing Arts, Neville Public Museum, Lambeau Field (home of the Green Bay Packers), Heritage Hill State Park,

Oneida Nation Museum, and National Railroad Museum. More information about the area can be found at: <http://www.uwgb.edu/biodiversity> and <http://www.packercountry.com>.

Meeting Location: The KI Conference Center

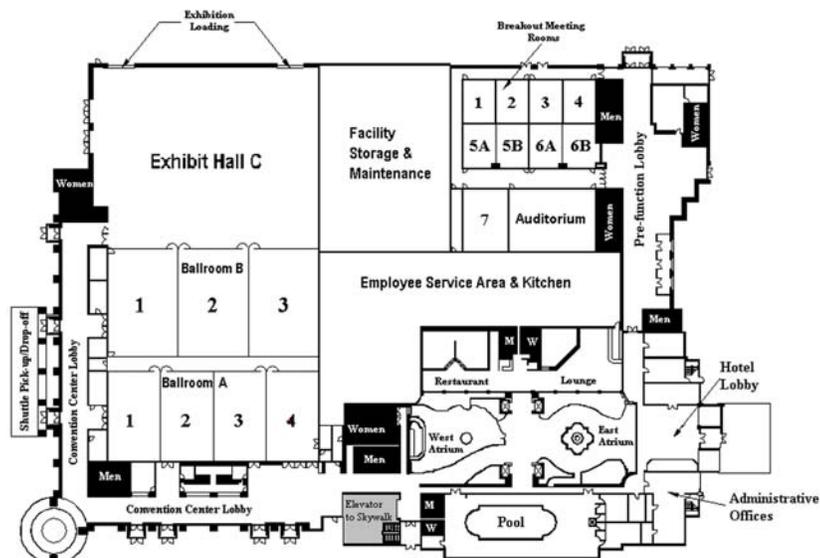
The conference will be held at the Regency Suites Hotel and the adjoining KI Conference Center, located in the heart of downtown Green Bay near the mouth of the Fox River. The Regency Suites Hotel features luxurious two-room suites with private bedroom and separate living areas, complete with a kitchen, wet bar, microwave, and refrigerator. All overnight guests of the Hotel receive a full complimentary breakfast each morning and a complimentary beverage reception each evening. The hotel/convention center complex includes a large indoor pool, whirlpool, sauna, exercise room, coffee shop, and deli. Free parking and complimentary transportation to and from the Austin Straubel International Airport is available between 6:00 am and 10:30 pm.



Directions to the KI Center:

- To get there from the airport: From Highway 41, take 172 East, exit onto Riverside Drive, turn right on Riverside Drive, (Riverside turns into Monroe Avenue) go to Main Street, turn left, we are 1 block on right).
- From I-43 South, take Webster exit, left on Webster to Main Street, turn right onto Main Street. Hotel is 3 blocks down on right.

KI Center Facility Map



Registration

Registration will be held in the KI Convention Center Lobby, South, from 5 -9 pm on Wednesday, from 7:30 am to 5:00 pm on Thursday and Friday, and from 7:30 – 10:00 am on Saturday.

Previewing

Presentations may be previewed in Meeting Rooms 5A/5B from 7-9 pm on Wednesday, and in Ballroom A, Room 3, from 11 am – 3 pm and 7-9 pm on Thursday, and 11 am – 3 pm on Friday.

Paper Sessions

Paper sessions will run throughout the conference in Ballroom A, Rooms 1, 2 and 4.

Poster Session

Poster presenters should set up their posters between 1 - 5 pm on Thursday, October 13 in the Conference Center Lobby. Posters should remain up for viewing during the entire conference; however, please remove them by 6 pm on Saturday, October 15.

Vendors/Exhibitors

Vendors and exhibitors will be set up from 8 am to 10 pm daily (except Tuesday) in the Convention Center Lobby.

Friday Evening Barbeque

The Friday evening barbeque will be from 6 -9 pm at the Cofrin Center for Biodiversity at UW-Green Bay. Please check at the registration desk for details.

Awards Banquet

The conference banquet and awards ceremony will be from 6-11 pm on Saturday, in the Main Ballroom. Please check at the registration desk for details.

Thursday, October 13

Ballroom A

8:30 - 9:30 am

Welcome and Keynote Address

The Recovery, Management and Future of Wisconsin's Peregrines

Greg Septon

10:00 – 10:20 am

Ballroom A, Room 1

Eagles

Determining the Accuracy of Using Morphometrics to Sex Nestling Bald Eagles (*Haliaeetus leucocephalus*) in the Great Lakes Region. **Kathryn A. Parmentier**, Glenn P. Birrenkott, William Bowerman, Amy S. Rowe, James G. Sikarski.

Ballroom A, Room 2

Owls

Polygyny in the Flammulated Owl (*Otus flammeolus*). **Brian D. Linkhart**, Erin R. Evers, Julie D. Megler, Eric S. Palm, Catherine M. Salipante, Scott W. Yanco.

10:20 - 10:40 am

Evaluating Great Lakes Bald Eagle (*Haliaeetus leucocephalus*) Nesting Habitat with Bayesian Inference. **Teryl G. Grubb**, William W. Bowerman, Allen J. Bath.

Western Great Lakes Region Owl Monitoring: results from 2005 and long-term perspectives. **David Grosshuesch**, Andy T. Paulios.

10:40 – 11:00 am

Evaluating exposure patterns and impacts of methylmercury on freshwater-feeding bald eagles (*Haliaeetus leucocephalus*) in Maine. **Christopher R. DeSorbo**, David C. Evers, Charles S. Todd, Steve Mierzykowski, William Hanson.

Seasonal Variations in the Diet of the Barn Owl (*Tyto alba*) in Central and Southern Punjab, Pakistan. **Muhammad Mahmood-ul-Hassan**, Mirza Azhar Beg, Muhammad Siddique.

Thursday, October 13

11:00 - 11:20 am

Ballroom A, Room 1

Eagles (cont.)

Bald Eagle (*Haliaeetus leucocephalus*) Natal Dispersal in the Upper Peninsula of Michigan. **Marjorie Gibson**, Joe Papp, Dan Murray.

Ballroom A, Room 2

Owls (cont.)

Behavioral Effects of Radio-collars on Western Burrowing Owls (*Athene cunicularia hypugaea*) in Northwest Texas. **Erica D. Chipman**, Nancy E. McIntyre, James D. Ray.

11:20 - 11:40 am

Longevity and Philopatry in Florida Bald Eagles. **Petra Bohall Wood**.

Barred Owls (*Strix varia*) in an Agricultural Landscape: Forest Loss, Fragmentation and Great Horned Owls (*Bubo virginianus*). **Mike S. Russell**, Susan J. Hannon.

11:40 am – 12:00 pm

Survival Probability and Mortality of Migratory Juvenile Golden Eagles (*Aquila chrysaetos*) from Interior Alaska. **Carol L. McIntyre**, Michael W. Collopy, Mark S. Lindberg.

Examining the Effects of Adult Female Body Condition Manipulations on Nestling Sex Ratios in Burrowing Owls (*Athene cunicularia*). **Nicole A. Taylor**, James R. Belthoff.

12:00 - 1:30 pm

Lunch

1:40 – 2:00 pm

Peregrine Falcons

Survivorship in a Population of Peregrine Falcons (*Falco peregrinus tundrius*) in the Canadian Arctic using Turnover and Mark-Recapture Analysis. **Alastair Franke**, Gordon Court, Mark Bradley, Mike Settingington, Robin Johnstone, Dave Abernathy, Tom Duncan.

Accipiters

Diet, Activity Patterns, and Predictability of Movement in Wintering Accipiter Hawks. **Timothy C. Roth II**, Steven L. Lima.

2:00 – 2:20 pm

Genetic Origin of Peregrine Falcons (*Falco peregrinus*) Breeding in Canada. **Marcel A. Gahbauer**, David M. Bird, Geoffrey L. Holroyd.

Determining Northern Goshawk (*Accipiter gentilis*) Breeding Area Occupancy, Nesting activity, and Reproduction in Northern Minnesota, 2003-2005. **Matthew J. Solensky**, Michelle L. Crozier, Maya Hamaday, David E. Andersen, Clint W. Boal.

Thursday, October 13

2:20 - 2:40 pm

Ballroom A, Room 1

Peregrine Falcons (cont.)

Population Genetics of Canadian Peregrine Falcons Through Space and Time. **Joseph W. Brown**, Tim P. Birt, Peter J. Van Coeverden de Groot, Gilles Seutin, Vicki L. Friesen.

Ballroom A, Room 2

Accipiters (cont.)

Assessing Landscape Structure in Northern Goshawk (*Accipiter gentilis*) Territories in Northern Minnesota. **Gaea E. Crozier**, Maya Hamaday, Richard J. Baker.

2:40 – 3:40 pm

Break

3:40 – 4:00 pm

Falcons

Exploring Aplomado Falcon Nest Success by Modeling Daily Nest Survival Rates. **Jessi L. Brown**, Michael W. Collopy, Erin J. Gott, Paul W. Juergens.

Open

4:00 - 4:20 pm

American Kestrel (*Falco sparverius*) Breeding Behavior: Patterns of Nest Attendance and Vocalization. **John A. Smallwood**.

Open

4:20 - 4:40 pm

Gyr Falcon (*Falco rusticolus*) Nest Site Fidelity on the Yukon Delta National Wildlife Refuge, Alaska. **Travis Booms**, Sandra Talbot, Brian McCaffery.

Open

4:40 - 5:00 pm

Population Genetic Structure of a Circumpolar Species: the Gyr Falcon (*Falco rusticolus*). **Jeff A. Johnson**, Kurt K. Burnham.

Open

Thursday, October 13

5:30 – 8:30 pm

**Convention Center Lobby
Poster Session and Reception**

Morphometrics of Adult Tundra Peregrines In Rankin Inlet, Nunavut, Canada. **Alastair Franke**, Gordon Court, Mark Bradley, Mike Settington, Robin Johnstone, Dave Abernathy, and Tom Duncan

Satellite Tracking Bald Eagles (*Haliaeetus leucocephalus*) in the Upper Midwest. **Brett A. Mandernack**, Matthew Solensky and Mark Martell

Great Gray Owls (*Strix nebulosa*) Nesting In Northeast Wisconsin. **Thomas O. Meyer** and Thomas C. Erdman

Ecology of Flammulated Owls in Boise National Forest, Idaho. **Keith P. Barnes** and James R. Belthoff

Fifty-two Years (1952-2004) of Band Recovery Data of Sharp-shinned Hawks (*Accipiter striatus*) at Cedar Grove Ornithological Station, Cedar Grove, Wisconsin USA. **Julie M. Gibson**, Helmut C. Mueller, Daniel D. Berger, Nancy S. Mueller, John L. Kaspar, and Johns Bowers

Effects of Radio Marking on Prairie Falcons: Attachment Failures Provide Insights about Survival. Karen Steenhoff, Mark R. Fuller, **Michael N. Kochert**, Kirk K. Bates, James O. McKinley and Paul M. Lukacs

Anger Management: The Behavior of Territorial Barred Owls (*Strix varia*) in Response to Conspecific Invasion. **Mike S. Russell** and Susan J. Hannon

Prevalence of West Nile Virus in Peregrine Falcons (*Falco peregrinus*). **Robert J. Dusek**, Erik K. Hofmeister, William S. Seegar, Michael A. Yates, Thomas L. Maechtle, and B. James Dayton

Primary and Secondary Poisoning of Raptors by Rodenticides in North America. **Steven R. Sheffield**

Roadway Mortality of Raptors in Southern Idaho. **Than J. Boves** and James R. Belthoff

Regional and Temporal Variations in Prey Selection of Nesting Golden Eagles (*Aquila chrysaetos*) in Japan. **Toru Takeuchi**, Saiko Shiraki, Makoto Nashimoto, Ryuki Matsuki, Sieya Abe, and Hitoho Yatake

How to Pack 25 5th Graders with Your Research Gear and Why You Should. **Travis Booms** and Mary Therian van Asten

Peregrine Falcons (*Falco peregrinus pealei*) Breeding Biology on Kiis Gwaa (Langara Island). **R. Wayne Nelson**

Friday, October 14

8:20 - 8:40 am

Ballroom A, Room 1

Raptors and Education

Federal Regulations for Using Raptors in Education. **Eliza Savage.**

Ballroom A, Room 2

Raptor Management

Southeast Alberta, Canada: An Investigation of Mortality Rates at Various Power Pole Configurations. **Cindy M. Platt,** Gordon S. Court, James A. Beck.

8:40 – 9:00 am

Care and Management of Captive Raptors II: A guide to Caring for Permanently Disabled Birds of Prey. **Lori R. Arent.**

Developing management plans for Steller's sea eagle (*Haliaeetus pelagicus*) breeding areas in the Russian Far East. **William W. Bowerman,** Vladimir B. Masterov, James G. Sikarski, David A. Best.

9:00 – 9:20 am

Housing Guidelines for Education Raptors. **Lori R. Arent.**

Northern Goshawk (*Accipiter gentilis*) Management in Minnesota; Can Surveys, Monitoring of Productivity, and Habitat Assessment Lead to an Assessment of Population Sustainability? **Maya Hamady,** Gaea E. Crozier, Michelle L. Crozier, Richard J. Baker.

9:20 – 9:40 am

Are the Birds Enough? **Jeannette W. Kelly.**

A National Survey for Bald Eagles (*Haliaeetus leucocephalus*) Proposed for Inclusion in the Post-Delisting Monitoring Plan: Status, Issues and Goals. **Scott L. Bearer,** Jody Gustitus Millar, Mark Otto, John R. Sauer.

Kites and Cooper's Hawks

9:40 - 10:00 am

Beyond the Birds: Habitat. **Jeannette W. Kelly.**

Nesting Biology of Urban Cooper's Hawks in Milwaukee, Wisconsin. **William E. Stout,** Robert N. Rosenfield, William Holton.

10:00 - 10:20 am

Break

Friday, October 14

10:20 – 10:40 am

Ballroom A, Room 1

Raptors and Education (cont.)

Birds of Prey Programs at Boyd Hill Nature Park in St. Petersburg, Florida. **Gabriel A. Vargo**, Donna M. Heinrich.

Ballroom A, Room 2

Kites and Cooper's Hawks (cont.)

Variation in Reproductive Indices in Three Populations of Cooper's Hawks in Southwestern Canada and Northern U.S. **Robert N. Rosenfield**, John Bielefeldt, Laura J. Rosenfield, Andrew C. Stewart, Melvin P. Nenneman, Robert K. Murphy, Michael A. Bozek.

10:40 – 11:00 am

Raptor Education in Classrooms and in the Field: An Informal Comparison of Environmental Education in Formal and Non-Formal Settings. Thomas W. Benedict, **Jeff P. Smith**.

Behavior of Fledgling Cooper's Hawks. **Jim Nicewander**.

11:00 – 11:20 am

Birds in Art and Film: Using Educational Raptors in the Creative Process. **Kate Davis**.

The Current Status and Conservation of Breeding Swallow-tailed Kites in Arkansas. **James C. Bednarz**, Troy J. Bader, Amy M. St. Pierre, Karen Rowe.

11:20 – 11:40 am

Casting the Parts for a Raptor Free Flight Program: From Design to Demonstration. **Sue Tygielski**.

Reproductive success and causes of nest failures for Mississippi Kites in the White River National Wildlife Refuge, Arkansas. **Troy J. Bader**, Jim Bednarz.

11:40 am – 12:00 pm

Raptor Handling and Basic Animal Training for Adult Volunteers. **Sue Tygielski**.

Survival and Timing of Mortality of Adult Swallow-tailed Kites, First-year Survival of Juveniles, and the Potential for Short-stopping of Sub-adults on the Newly Discovered Winter Range of Austral-breeding Conspecifics. **Kenneth D. Meyer**, Gina M. Zimmerman, Robert E. Bennetts, Marcos Azevedo.

Friday, October 14

12:00 - 1:30 pm

Lunch

1:40 - 2:00 pm

Ballroom A, Room 1

Raptors and Education (cont.)

Expanding Appreciation for Raptors:
Environmental Education through Creative
Writing. **Katie Fallon.**

Ballroom A, Room 2

**Red-shouldered, Swainson's, and
Galapagos Hawks**

Using Presence/Absence Surveys to Assess
Status and Population Trend of Red-
Shouldered Hawks (*Buteo lineatus*) in Central
Minnesota. **Carlene Henneman**, Mary Anne
McLeod, David E. Andersen.

2:00 – 2:20 pm

Building Bridges: Community Partnerships to
Promote Raptor Education. **Jesse A. Fallon.**

Dispersal and Mortality of Suburban Red-
shouldered Hawks (*Buteo lineatus*) in Ohio.
Cheryl R. Dykstra, Jeffrey L. Hays, Melinda
M. Simon, John B. Holt, G. Ronald Austing, F.
Bernard Daniel.

2:20 – 2:40 pm

Raptor Educational Programs for the New
Millennium I. **Walter C. Crawford, Jr.**

Red-shouldered Hawk (*Buteo lineatus*) Nesting
Behavior as Determined by Time-lapsed Video
Cameras in Wisconsin. **Eugene A. Jacobs**,
John P. Jacobs, James E. Woodford.

2:40 – 3:00 pm

Raptor Educational Programs for the New
Millennium II. **Walter C. Crawford, Jr.**

Survival and Recruitment Rates of Swainson's
Hawks in the Butte Valley, CA. **Chris W.
Briggs**, Brian Woodbridge, Michael W.
Collopy.

3:00 – 3:20 pm

Maintaining Healthy Residents: The Impact of
West Nile Virus. **Betsy Finch.**

Survivorship Analysis on a Study Population of
Marked Galápagos Hawks (*Buteo
galapagoensis*): Are Cooperating Males
Betting on a Longer Life? Kenneth M.
Levenstein, **James C. Bednarz**, Michelle
Donaghy Cannon, Patricia G. Parker.

Friday, October 14

Ballroom A, Room 1

3:20 – 3:40 pm

Break

3:40 – 4:00 pm

Ballroom A, Room 2

Raptor Health

Serologic Evidence of West Nile Virus Infection in Three Wild Raptor Populations. **William E. Stout**, Andrew G. Cassini, Jennifer K. Meece, Kurt D. Reed, Joseph M. Papp, Robert N. Rosenfield.

Open

4:00– 4:20 pm

Measuring the Effects of West Nile Virus on Wild American Kestrel (*Falco sparverius*) Populations in Colorado. **William M. Iko**, Robert J. Dusek, Erik K. Hofmeister.

Open

4:20– 4:40 pm

The Key to Maintaining Healthy Feet in Captive Raptors. **Marjorie Gibson**.

Open

4:40– 5:00 pm

Falconry: Recreational Opportunity, Hunting Effort and Success, and Resource Impact in Alberta, Canada. **Alastair Franke**, R. Wayne Nelson.

Open

6:00– 9:00 pm

Cofrin Center for Biodiversity, University of Wisconsin - Green Bay Barbeque

Guest Speaker: Alberto Palleroni, Harvard University
Anti-Predator Behavior

7:30 pm, Room 208 Mary Ann Cofrin (MAC) Hall

Saturday, October 15

Ballroom A, Room 4

10:15 am – 12:00 pm

RRF Business Meeting – All RRF Members

12:00 – 3:20 pm

Lunch

3:20 – 3:40 pm

Northern Great Basin Raptor Nest Survey: Project Overview and Preliminary Results 2000–2005. **Jeff P. Smith.**

3:40 - 4:00 pm

Determining Appropriate Landscape Scale for Habitat Description and Analyses, and Preliminary Landscape Selection Patterns for Two Raptor Species. **William E. Stout**, Stanley A. Temple.

4:00 - 4:20 pm

Great Black-backed Gulls as Raptors: Who Needs Talons? Christina Donehower, **David M. Bird**, Steve Kress.

4:30 – 5:30 pm

Special Presentation:

In Search of the Ivory-Billed Woodpecker

Jim Fitzpatrick
The Carpenter Nature Center

ABSTRACTS

(IN ALPHABETICAL ORDER BY FIRST AUTHOR'S LAST NAME)

KEYNOTE ADDRESS: THE RECOVERY, MANAGEMENT, AND FUTURE OF WISCONSIN'S PEREGRINES

GREG SEPTON, Society of Tympanuchus Cupido Pinnatus, Ltd., 11100 W. Ryan Rd., Franklin, WI 53132 USA.

This presentation will provide an overview of Peregrine Falcon recovery efforts in Wisconsin between 1987-2005. Discussions will include recovery methods and approaches utilized in the creation of an urban nesting population along the Lake Michigan shoreline. Also covered will be nest box designs, urban nest site management issues and resolutions, band returns, environmental contaminants, dispersal of hacked and wild-produced falcons, nesting chronology, prey species, overwintering, and the role of electric power generating plants in the recovery of the population. The recent reoccupation of historical cliff eyries along the Mississippi River and current recovery efforts on the Door Peninsula will also be covered. And finally, we'll take a look at what the future may hold for the Peregrine Falcon in Wisconsin.

SPECIAL LECTURE: RAPTORS AS PREDATOR MODELS IN ETHOLOGY

ALBERTO PALLERONI, Primate Cognitive Neuroscience Laboratory, Department of Psychology, Harvard University, Cambridge, MA 02138 USA.

Predatory birds represent a unique class of predators because of their size and ability to fly. Prey species have evolved many specific defenses to aerial predators, ranging from complex evasive maneuvers to alarm calls referring only to threats from the sky. Almost 70 years have elapsed since Tinbergen's classic study using raptor silhouettes launched the study of an animal's responses to this danger. Here I will review our current understanding of this predator-prey relationship and highlight recent naturalistic experiments with trained and wild raptors. From the high-speed attacks of falcons to the stealthy stalks of forest raptors, I will discuss the functional and evolutionary explanations of the arms race between birds and their prey.

SPECIAL PRESENTATION: IN SEARCH OF THE IVORY-BILLED WOODPECKER

JIM FITZPATRICK, Carpenter St. Croix Valley Nature Center, 12805 St. Croix Trail South, Hastings, MN 55033 USA. **DR. JOHN W. FITZPATRICK**, Cornell Lab of Ornithology, 159 Sapsucker Woods Road, Ithaca, NY 14850 USA.

Last formally documented in 1944, most current field guides and ornithologists refer to the Ivory Billed Woodpecker as extinct. An obligate bottomland hardwood forest resident, the bird was forced from its southeast US breeding grounds by the logging industry. Various reports of the bird through the subsequent years were almost universally shrugged off as pileated woodpeckers until a sighting in Louisiana in 1999. This triggered several unsuccessful but intensive searches over the next several years. A report from central Arkansas in February of 2004 began a renewed search and resulted in the formation of a large coalition of partners into The Big Woods

Oral Abstracts

Conservation Partnership. In April of 2005 the announcement was made that there were indeed sightings and a video of the bird. This author is the owner of one of the seven sightings described by a team of authors in the Journal of Science. While no recent film or digital pictures of the subject bird yet exist, documentation of the search areas, processes and sighting spots and a grainy video of the bird will highlight the reason for the Cornell Lab of Ornithology's recent declaration that the Ivory Billed woodpecker is alive in the Arkansas delta.

CARE AND MANAGEMENT OF CAPTIVE RAPTORS II: A GUIDE TO CARING FOR PERMANENTLY DISABLED BIRDS OF PREY

LORI R. ARENT, The Raptor Center, College of Veterinary Medicine at the University of Minnesota, 1920 Fitch Ave., St. Paul, MN 55082 USA.

In the field of environmental education, many educators use live visual aids to enhance the delivery of their key messages. Over the past 20 years, live birds of prey have become popular educational ambassadors. Many that are utilized are permanently disabled birds that were treated by rehabilitation facilities and deemed non-releasable. They have special needs due to their physical or mental handicaps and require specialized care 365 days a year. This presentation will provide a glimpse into the second edition of "Care and Management of Captive Raptors, A guide to caring for permanently disabled raptors" written by Lori Arent, The Raptor Center, College of Veterinary Medicine at the University of MN. This book is designed as a reference tool for people currently managing collections of education raptors and for those first considering keeping raptors for educational use. It covers a wide range of topics including how to decide if having raptors is right for you; picking the most suitable species and individuals; providing the best housing, diet, and medical care; training and handling methods; and quality of life standards.

HOUSING GUIDELINES FOR EDUCATION RAPTORS

LORI R. ARENT, The Raptor Center, College of Veterinary Medicine at the University of Minnesota, 1920 Fitch Ave., St. Paul, MN 55082 USA.

Housing a raptor in captivity consists of two major components: providing a "safe" space that provides shelter from the elements, security from predators, prevents accidental escape, and prevents a bird from injuring itself; and creating a living environment that not only keeps a raptor healthy, but also provides enrichment to enhance its quality of life. This presentation will touch on both components, including appropriate building materials, enclosure size and location; predator proofing methods; perch materials and placement; water; and management modifications that can enhance the life of a captive raptor.

**REPRODUCTIVE SUCCESS AND CAUSES OF NEST FAILURES FOR MISSISSIPPI KITES
IN THE WHITE RIVER NATIONAL WILDLIFE REFUGE, ARKANSAS**

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Previous research on Mississippi Kites (*Ictinia mississippiensis*) at the White River National Wildlife Refuge in Arkansas (WRNWR) documented a very low nest success rate (27.3%, N = 22 nests). Here, we describe the continuation of this work with emphasis on determining the causes of nest failures. From 24 April through 1 July 2004, we located 21 Mississippi Kite nests. We used three infrared time-lapsed video recording systems at a total of seven Mississippi Kite nests to monitor the nest 24 hr a day. A total of 176 days of video data were recorded within a 14-wk period. The fates of the remaining nests were monitored periodically by observation using a spotting scope. A "hair snare" was constructed of barb wire and placed 1.5 m above the ground on each nest tree to collect hair samples of any possible terrestrial predators that climbed the tree in attempt to reach the nest. Nine of the 21 Mississippi Kite nests hatched young resulting in 42.9% (N = 21) hatching success. Of these nests, only six fledged one juvenile each, resulting in a 28.6% (N = 21) fledging success. Review of the videos documented two events that led to nest failures and two predation attempts that did not lead to failure. One sample of hair from a Virginia opossum (*Didelphis virginiana*) was collected from a hair snare; however, this nest was successful. Including data from 3 yr of previous research, the nest success (28.0%, N = 43 nests; a total of 12 chicks fledged) of kites is likely not adequate to sustain this population, suggesting the WRNWR Mississippi Kite population represents a sink population.

**A NATIONAL SURVEY FOR BALD EAGLES (*HALIAEETUS LEUCOCEPHALUS*)
PROPOSED FOR INCLUSION IN THE POST-DELISTING MONITORING PLAN:
STATUS, ISSUES AND GOALS**

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In July 1999, the Bald Eagle was proposed for delisting in the lower 48 states. To establish nationwide population trends and to assure the detection of any future population decline, post-delisting monitoring is required (Endangered Species Act Section 4(g)(1)). A draft monitoring plan, which essentially proposed a continuation of collating state data, was provided with the 1999 delisting rule (64 FR 36454). Comments received during the public comment period questioned many aspects of this method. A workshop to assess various survey methods was

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held at Patuxent, Maryland in September 2000. That workshop resulted in a proposal to evaluate the dual frame method of sampling bald eagle populations. The pilot study to test the dual frame method was conducted in Maine in 2004 and Florida, Minnesota, and Washington in 2005. We evaluate the pilot study that incorporates information from known nest sites (list frame) in conjunction with an area-based sampling frame (area frame) to estimate the total number of nests for the state. For the national survey, sampling would be expanded to multiple representative states or to multi-state regions. The data, knowledge and experience gained from the pilot study will be applied towards the development of a nationwide bald eagle survey.

THE CURRENT STATUS AND CONSERVATION OF BREEDING SWALLOW-TAILED KITES IN ARKANSAS

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Between the 1940s and 1990s, Swallow-tailed Kites (*Elanoides forficatus*) were not reported in Arkansas and this species was assumed to be extirpated. More recently (1998-2000), several sightings of this species have been documented (April-August) in the vicinity of the White River National Wildlife Refuge (WRNWR). Since 2001, we searched the WRNWR extensively to document the status of the Swallow-tailed Kite in Arkansas. On 24 May 2002, we located an occupied Swallow-tailed Kite nest, the first nest documented in Arkansas in over 100 yr. This nest failed shortly after our discovery. We found a second nest under construction on 19 May 2004. A kite was observed in incubating position on this nest on 25 May, but the nest was abandoned by 30 May 2004. This year, we found a kite in incubating position on a nest on 23 May 2005. During a site check on 1 June, two nestlings were found dead underneath the nest with puncture wounds. As these three nests were located within a remote 3-km-diameter area in different years, we suggest that these breeding attempts involved at least one of the same adults. Significant in 2005 was that the birds apparently laid eggs approximately 4 wk earlier (mid April) than in previous years (mid to late May), and that the eggs hatched. As this species seems to have a high fidelity to breeding sites and tends to nest in loose colonies, some observers have suggested that single pairs of kites are unlikely to colonize vacant habitat. Therefore, this ongoing natural re-colonization in Arkansas is significant as this nesting area is approximately 370 km north of the closest known occupied Swallow-tailed Kite habitat. Our findings suggest that natural breeding range expansion by kites into historical habitat will face serious obstacles, and that close monitoring and management may be needed to reduce factors that could potentially cause nest failures and to support successful re-colonization.

RAPTOR EDUCATION IN CLASSROOMS AND IN THE FIELD: AN INFORMAL COMPARISON OF ENVIRONMENTAL EDUCATION IN FORMAL AND NON-FORMAL SETTINGS

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HawkWatch International has conducted long-term migration studies at multiple sites in the western U.S. since 1977. In conjunction with our research projects, we have been engaged in environmental education at several of our field sites since starting those operations. In 1990, HawkWatch International implemented an internship program in which educators in Salt Lake City, UT and Albuquerque, NM use non-releasable raptors during school classroom presentations. While closely related, our field and classroom education programs accomplish different objectives, reach diverse audiences, and pose unique challenges. Using research as the foundation, we have found both types of education to be highly successful. Our programs focus on raptor ecology/biology, migration, scientific methodology, conservation issues and practices, environmental stewardship, and attempt to instill a sense of wonder in audiences of all ages. The second edition of our teachers' guide, *Raptor Ecology*, has just gone to press with lesson plans correlated to Utah's Core Curriculum. At the same time, federal and state curriculum standards continue to shift focus and funding away from environmental education. Remote study sites often preclude schools from engaging in site visits in the form of field trips. Time constraints for in-school programs results in straddling the line between environmental interpretation and environmental education in its truest sense. We are currently investigating the efficacy of our distinct programs. This presentation will compare and contrast the successes and challenges inherently tied to field-site and classroom raptor education.

GYRFALCON (*FALCO RUSTICOLUS*) NEST SITE FIDELITY ON THE YUKON DELTA NATIONAL WILDLIFE REFUGE, ALASKA

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Little is known about Gyrfalcon (*Falco rusticolus*) nest site fidelity across their circumpolar distribution. However, quantifying fidelity rates (or breeding dispersal patterns if not site-faithful) is important for interpreting population survey data and estimating population size. Therefore, we are studying Gyrfalcon nest site fidelity on the Yukon Delta National Wildlife Refuge using DNA microsatellite analysis of adult molted feathers collected near nests. We have determined that a four-locus suite of microsatellite loci are sufficiently variable to allow individual identification of Gyrfalcons within this population (probability of identity = 0.0006). Microsatellite and additional genetic data were gathered from DNA extracted from the proximal end of molted feathers collected at or near nest sites, and we demonstrate we can differentiate multiple individuals leaving molted feathers at the same nest site. By collecting molted feathers

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from all known nest locations (n = 14) and identifying (i.e. marking) each bird in the study area via an individual-specific microsatellite signature, we have been able to document the extent of spatial and temporal Gyrfalcon breeding movements within a mark-recapture framework for the first time in Alaska. This paper summarizes results from our first two years of field collections (2003 and 2004). Preliminary results and potential applications to other studies, such as paternity studies, will be discussed.

DEVELOPING MANAGEMENT PLANS FOR STELLER'S SEA EAGLE (*HALIAEETUS PELAGICUS*) BREEDING AREAS IN THE RUSSIAN FAR EAST

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The Russian Far East is the only region where Steller's sea eagles nest. There are estimated to be approximately 7500 individuals in the population. Threats to these eagles include overfishing, lead poisoning, human encroachment, oil production, and aquatic pollutants. Virtually their entire breeding range will be developed for oil production over the next 20 years. While most of the development will be offshore, infrastructure including oil terminals and pipelines will be built on shore. For 20 years, ecological studies have been conducted to determine reproductive productivity, food habits, nesting preferences, migration patterns, and effects of human activities. We have used the results of these studies to create management guidelines for Steller's sea eagle breeding areas. We have adapted the basic guidelines for Bald eagle (*Haliaeetus leucocephalus*) breeding areas found in the Northern States Bald Eagle Recovery Plan for Steller's sea eagles. We will present these guidelines. The results of population monitoring of this species, conducted by the second author, indicates that these eagles will most likely decline in numbers over the next few decades. We will present the known ecological and anthropomorphic stressors associated with this decline. We will also describe our plans for future research, management, and protection of this species.

SURVIVAL AND RECRUITMENT RATES OF SWAINSON'S HAWKS IN THE BUTTE VALLEY, CA

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We examined survival estimates of 204 marked Swainson's hawks (*Buteo swainsoni*) in the Butte Valley of California using standard Cormack-Jolly-Seber models in Program MARK from 1990-2004. We included several covariates in the analysis (e.g., the average breeding success of each individual and territory most commonly used). Preliminary results indicate that males have a higher recapture rate than females (79% and 74%, respectively). The best models demonstrated that survival was constant for both sexes and through the study, except for an apparent decline between 1995 and 1998, when survival dropped from 85% to 81%. This coincides with the period when monocrotophos was in heaviest use in the pampas of Argentina and caused mass die-offs of wintering Swainson's hawks. Similarly, there has been a significant decrease in recruitment rates of marked individuals from 1996 through at least 2000. Recruitment rates decreased from approximately 8% to less than 3% after 1996 in both sexes. These results highlight the importance of examining relationships between life-history characteristics and conditions in wintering grounds of migratory birds.

POPULATION GENETICS OF CANADIAN PEREGRINE FALCONS THROUGH SPACE AND TIME, *FALCO PEREGRINUS*.

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The peregrine falcon, *Falco peregrinus*, is among the most recognized, empathized, and emphasized higher vertebrate species at risk in North America. After being essentially extirpated east of the Great Plains, extensive reintroduction programs, in conjunction with curtailing organochlorine contaminants, have seen a dramatic increase in census population sizes. However, despite the wide interest in the fate of this species, very little is known about the genetics of post-reintroduction populations. Here we utilize data from the mitochondrial control region and 11 nuclear microsatellite loci taken from museum ($n = 96$) and contemporary ($n = 187$) individuals to examine the level and distribution of genetic variation across both space and time. Of the three North American subspecies, the west coast marine race *F. p. pealei* was found to be well differentiated genetically from all other populations ($F_{ST} \sim 0.08$). We find that the historical partitioning of continental *F. p. anatum* and arctic *F. p. tundrius* races is artificial, as individuals from these subspecies are genetically indistinguishable. However, contemporary populations of the two subspecies are diagnosably different. Changes in structure are due

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entirely to changes within *F. p. anatum*, presumably from the restricted gene pool and/or introgression of foreign alleles from reintroduction programs. Despite expectations, no genetic bottleneck signature was found in any population using a variety of tests. This is rationalized by the promptness of recovery and the introduction of non-native genetic material.

EXPLORING APLOMADO FALCON NEST SUCCESS BY MODELING DAILY NEST SURVIVAL RATES

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We investigated nest success during 2002-2004 for a reintroduced population of Northern Aplomado Falcons (*Falco femoralis septentrionalis*) in two study sites in southern Texas. We monitored 97 nesting attempts from initiation through failure or successful fledging (defined as ≥ 1 young fledged) and measured various physical nest site characteristics. These characteristics were simplified via a principal components analysis (PCA) and the first six principal components, cumulatively accounting for 62.97% of the variance, were retained. We used an information-theoretic approach to explore competing hypotheses describing falcon nesting ecology utilizing the maximum likelihood-based nest survival model implemented in program MARK. Daily nest survival rates (DSR) were modeled as a function of nest age, season, year, study site, and nest characteristic principal components, and subsequent models were evaluated by Akaike's Information Criterion (AIC) scores. DSR did not vary between years, throughout the season, or by study site, but did vary due to nest age; DSR was lowest during hatching and early nestling phase. Nest site characteristics also were important, as a quadratic effect of the first principal component greatly improved the age-trend model. Principal component 1 (PC1) indicated that tall nests, either artificial platforms or Chihuahuan Raven (*Corvus cryptoleucus*) nests on power poles, had higher DSR than lower nests that were natural niches in grass or those built by Crested Caracaras (*Caracara cheriway*). The PC1 effect on DSR was most pronounced during hatching and early nestling phase, and less so during incubation and late nestling phases. These findings suggest that certain nest features increase vulnerability to predation when parental behaviors and nest visitation rates change abruptly during hatching. Our analysis suggests that well-designed man-made structures (i.e. relatively tall) could maximize falcon nest success.

**BEHAVIORAL EFFECTS OF RADIO-COLLARS ON WESTERN BURROWING OWLS
(*ATHENE CUNICULARIA HYPUGAEA*) IN NORTHWEST TEXAS**

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Although radio telemetry is commonly used in studies of Western Burrowing Owls, behavioral effects of radio-collars on this species are unknown. We hypothesized that radio-collared male Burrowing Owls would spend a significant amount of time interacting with their collars and as a result spend less time in activities such as foraging and provisioning young. We monitored breeding male Burrowing Owls in the Amarillo and Lubbock, Texas, areas in 2004 and again in Lubbock in 2005. In 2004 eight male owls were observed as a paired treatment and control (four owls with radio-collars and four without). Behavioral activity budgets varied considerably among individuals, dates, and time of day. Activity budgets significantly differed between pre-collar and treatment periods with respect to preening and vigilance. Radio-collared owls spent a large amount of time interacting with their collars. We replicated this study in 2005 using a modified design: eight radio-collared male owls were observed prior to receiving a collar, while collared, and after collar removal; collars were not removed from four of these males, allowing for a simultaneous treatment vs. control comparison. Results from the 2005 field season are currently being analyzed but it is evident that owls did not ignore the presence of radio-collars. Future studies that employ radio-telemetry on Western Burrowing Owls may need to account for behavioral effects of radio-collars.

ASSESSING LANDSCAPE STRUCTURE IN NORTHERN GOSHAWK (*ACCIPITER GENTILIS*) TERRITORIES IN NORTHERN MINNESOTA

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The Northern Goshawk is a good landscape-level indicator of forest ecosystem health because it requires large patches of mature upland forest and forages over a large spatial scale of several square miles. Minnesota is in the process of developing forest management plans for each of its ecological subsections. To provide input for these plans, we are examining the current landscape structure and disturbance rates in 15 goshawk territories that encompass large amounts of state land. Results from this analysis could suggest modifications to the Minnesota DNR's current goshawk habitat recommendations. For the six territories completed thus far, an average of 49% of the nesting area (a 500-m radius circle centered on the nest) is mature upland forest (preferred goshawk habitat), 27% is young upland forest, 18% is lowland forest, and 6% is non-forested. In the foraging area (a 4.8-km radius circle centered on the nest), 28% is mature upland forest, 23% is young upland forest, 22% is lowland forest, and 27% is non-forested. Four of the six territories had less than 25% of preferred goshawk habitat in large patches (> 240 ha). The area

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disturbed in the territories over the past 25 years (from logging, development, etc.) averaged 22% of the nesting area and 18% of the foraging area. The rate of disturbance generally increased from the 1980s to the 1990s in the nesting areas but decreased during this time period in the foraging areas. Disturbance occurred within the 12-ha buffer area surrounding the nest in three of the six territories. We will examine how the landscape structure in these territories has changed over the past decade, and we will model several scenarios of what the territories might look like in 10 years.

BIRDS IN ART AND FILM: USING EDUCATIONAL RAPTORS IN THE CREATIVE PROCESS

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Kate Davis, Director of Raptors of the Rockies has provided nearly one thousand educational programs with live raptors. She is an internationally recognized artist, and increasingly popular are sessions of Birds In Art, ranging from an hour to week-long workshops. Programs begin with discussion of structure and function and illustrations of general topography - the skeleton, musculature, dorsal and ventral wing, silhouettes perched and in flight. Live birds are used as models, and a demonstration of sketching focuses on anatomy. All mediums may be explored including drawing, painting, and printmaking, to sculptures in clay, metal, and paper mache. We will see some examples of student artwork produced over the years, and discuss the sculpting process in paper mache. These sessions have been valuable to both budding artists and seasoned professionals. Raptors of the Rockies hosts Young Filmmakers Workshops in conjunction with the International Wildlife Film Festival. Up to ten students per session enjoy a week exploring videography, both technical and artistic. They research their topic of interest and learn storyboarding and scripting, with a discussion of wildlife film ethics. Then a full day is spent "shooting" the birds at the ranch to get the required footage for each project. Two days are then used to learn editing, and adding titles and soundtracks. Films have a grand debut at the end of the week and are entered in the Wildlife Film Festival. We will view a short award winning film made by two middle school students. Kate Davis also makes 30-minute films of the birds for Missoula Community Access Television and we will see an excerpt. These creative endeavors allow educational birds to be utilized and appreciated in exceptional ways, and they may reach a wider audience.

EVALUATING EXPOSURE PATTERNS AND IMPACTS OF METHYLMERCURY ON FRESHWATER-FEEDING BALD EAGLES IN MAINE

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We present preliminary findings from year one of a three-year (2004-2006) effort to evaluate spatial and temporal patterns of mercury exposure in Bald Eagle (*Haliaeetus leucocephalus*) nestlings and adults in Maine as well as to assess impacts on long-term productivity. Nestling blood displayed a significant negative correlation to productivity (3, 5, and 10-year). Nestling blood and adult feathers both reflected higher mercury exposure in lacustrine habitats compared to riverine sites. Statewide spatial patterns indicated that mercury exposure was highly variable with distinct "biological hotspots," many of which were in agreement with other species sampled within the same area (e.g., Common Loons *Gavia immer*, and yellow perch, *Perca flavescens*). Preliminary comparisons to previous sampling efforts in 1991-1992 indicate little decline in methylmercury availability as indicated by eagle nestlings in lacustrine habitats; while riverine sites may display similar or possibly higher mercury levels than those over a decade ago. Shed adult feathers (primarily flight feathers) ranged from <1 ppm to 87.4 ppm (fw) with a significant portion exceeding levels reported in other populations. Findings suggest that a portion of Maine's freshwater-feeding Bald Eagle population is exposed to high levels of methylmercury, which may be limiting the recovery of this breeding population.

GREAT BLACK-BACKED GULLS AS RAPTORS: WHO NEEDS TALONS?

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Raptors or birds of prey are generally defined as 'birds that use strong toes equipped with sharp, hooked talons to hold their food while tearing at it with a hooked beak.' In this paper, we describe "raptorial" behavior in Herring Gulls (*Larus argentatus*) and Great Black-backed Gulls (*L. marinus*). At seabird restoration sites in the Gulf of Maine, fledgling young of Common Eiders (*Somateria mollissima*) and adults and young of terns (*Sterna* spp.) are primary prey for these large gulls. To date, few studies have quantified gull predation or examined the predatory behavior of gulls at these sites. Among other objectives, our study documents various methods of gull-seabird interaction and the impact of this predation on restoration programs. During the years 2003 - 2005, both gull species were observed and videotaped at Eastern Egg Rock and Stratton Island, Maine. While only a few gulls were predatory, their impact on both eider and tern chicks is significant. We present a summary of the raptorial behavior along with video sequences of opportunistic group predation.

DISPERSAL AND MORTALITY OF SUBURBAN RED-SHOULDERED HAWKS (*BUTEO LINEATUS*) IN OHIO

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We banded nestling Red-shouldered Hawks in suburban southwestern Ohio (SW OH) and rural south-central Ohio, in order to examine dispersal behavior and to determine causes of mortality. Of 1060 nestling Red-shouldered Hawks banded in SW OH between 1955 and 2004, a total of 54 (5.1%) were encountered (dead or alive) by June 2005. Of 290 nestlings banded in rural south-central Ohio between 1997 and 2004, only two (0.7%) were encountered by June 2005. For SW OH birds, mean distance from the natal nest at the time of the encounter was 39.8 ± 12.5 km, which was not correlated with hawk age. Most birds moved < 30 km, but six were recovered 103 - 500 km away. Cumulative exponential distribution (CED) analysis of distance from natal nest at the time of encounter indicated that 50% of SW OH Red-shouldered Hawks were found < 15.1 km from their natal nest, 75% were found < 30.1 km away and 95% were found < 65.1 km away. Natal dispersal averaged 16.4 ± 3.7 km, N = 27 (males 10.3 ± 2.6 km, N = 6; females 18.1 ± 3.4 km, N = 7, 14 sex undetermined). Mean age for the hawks recovered dead was 1.8 ± 0.4 years (N = 35). CED analysis of age at recovery indicated that 50% of Red-shouldered Hawks were dead by age 1.1 yr, 75% by age 2.1 yr, and 95% by age 4.5 yr. Of the 32 SW OH Red-shouldered Hawks that were recovered dead, 16 (50%) were simply found dead, 5 (16%) were hit by vehicles, 4 (13%) were electrocuted, 4 (13%) were found injured and later died, and one each (3%) were caught in a trap, shot, and found as a band with bone or skeleton only.

BUILDING BRIDGES: COMMUNITY PARTNERSHIPS TO PROMOTE RAPTOR EDUCATION

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While captive birds of prey alone are an effective means for reaching audiences, as educators we need to continue to imagine new and creative ways to spread our message as well as secure the funds necessary to continue our work. One way to expand the impact of our programs is through interaction with other community groups and organizations. This discussion will examine three specific instances of unique community relationships that have helped the West Virginia Raptor Rehabilitation Center (WVRRRC) to benefit the birds, the community, and the environment. The WVRRRC holds an annual Pow-Wow in conjunction with the Middle Island Creek Shawnee tribe and the West Virginia University Native American Studies program. This event provides the

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opportunity to educate the public not only about raptors and the environment, but also about the American Indians whose cultural history is strongly tied to these birds. A seemingly unlikely partnership with Dominion Energy has helped the WVRRC with habitat restoration projects on the future site of an improved raptor education facility. The WVRRC has also succeeded in developing a mutually beneficial relationship with the West Virginia Trophy Hunters Association to promote the well-being of native wildlife. The West Virginia Trophy Hunters Association not only provides financial support, but also promotes the WVRRC's education program to other hunting and fishing organizations around the state. These community partnerships have provided ideal venues to reach those perhaps less likely to attend environmental activities, as well as helped to secure funding to achieve our educational goals.

EXPANDING APPRECIATION FOR RAPTORS: ENVIRONMENTAL EDUCATION THROUGH CREATIVE WRITING

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The West Virginia Raptor Rehabilitation Center conducts approximately 100 educational programs each year. The vast majority of program requests come from science teachers, scout groups, 4-H clubs, and nature camps, and typical education programs focus on basic biological aspects of raptors and the environment—natural history, predator-prey relationships, evolutionary adaptations, the food chain, the importance of clean water and air, etc. Educators hope that students will develop an appreciation for raptors and natural systems through these science-based programs. However, a rarely-explored way to expand appreciation for raptors is through creative writing. In addition to reaching a broader demographic, using raptors to teach creative writing (and using creative writing to learn about raptors) allows for a discussion of issues that may not be included in a traditional raptor education program. In a creative writing/raptor education class, students can discuss the implications of anthropomorphism in writing by addressing the ways anthropomorphizing hurts (or helps?) raptors. Students can also hone their abilities of careful observation and attention to detail, essential to successful creative writing, by composing descriptions of raptors using sensory images. Additionally, students can read and analyze the work of published authors who have also written about raptors. Expanding raptor education to include creative writing not only extends appreciation of these birds to a wider audience, but may also add to the growing body of raptor-inspired literature. The presentation will highlight curriculum being developed at the West Virginia Raptor Rehabilitation Center. The WVRRC plans to make raptor-inspired creative writing classes available to the public in addition to the more traditional education programs already in place. The presentation will also discuss how some of the WVRRC's ideas were used in university creative writing classes at Virginia Tech.

MAINTAINING HEALTHY RESIDENTS: THE IMPACT OF WEST NILE VIRUS

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Care and maintenance of permanent residents was fairly straightforward – until the West Nile Virus appeared. When it swept through Nebraska in 2002, treatment was mainly supportive. Since then, a combination of treatment and preventative vaccinations have been used with great success.

FALCONRY: RECREATIONAL OPPORTUNITY, HUNTING EFFORT AND SUCCESS, AND RESOURCE IMPACT IN ALBERTA, CANADA

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We present data that trace the hunting activities of the Alberta Falconry Association (AFA) in the province of Alberta, Canada over a 15 year period between 1989/90 and 2003/04. During this period the number of actively hunting falconers each season increased from 11 to 21. There have been a total of 36 falconers registered with the association over the course of the survey. The mean number of days hunted by all falconers in any given year was 57 ± 10 (range 42 – 84). The maximum number of days hunted in a single season by a single falconer ranged from 83 to 240 (mean = 121 ± 41). The mean number of hours spent hours afield each hunting day was 3.2 ± 0.4 and, across all actively hunting falconers, the mean number of quarry caught in any given year was 21.6 ± 10.2 . The maximum number of quarry caught by a single falconer in a single season was 204. Hunter success improved from one quarry captured per 9 hunting days to one per 2.5 hunting days. Hunter effort was higher for falconers than for shotgun hunters. The average gun-hunter spent 4.6 days hunting ducks and 5.0 days hunting grey partridge in any given year. The average falconer spent 31.8 hunting ducks and, 13.9 and 21.6 days hunting gray partridge in the regular and extended season respectively. The number of quarry taken per hunting day across all years surveyed was substantially lower for falconers (mean = 0.37, range 0.12 - 0.63) than for gun hunters (mean 1.00, range 0.20 -2.10). Estimated total falconer harvest was 4791 head of quarry over the course of the survey, whereas total gun-hunter harvest over the same period was estimated to be 2,916,644. The falconry harvest represents 0.16% of the total harvest.

SURVIVORSHIP ANALYSIS IN A POPULATION OF PEREGRINE FALCONS (*FALCO PEREGRINUS TUNDRIUS*) IN THE CANADIAN ARCTIC

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Turnover and mark-recapture analysis are conservation tools that can be used in any situation where animals can be marked and subsequently identified by recapture or re-sighting. Between 1982 and 2004, the encounter histories of more than 170 adult peregrine falcons at Rankin Inlet, Canada were constructed. The occupants of breeding territories were recorded over the same period. We estimated and compared survivorship using Cormack-Jolly-Seber (CJS) methodology and turnover analysis. Preliminary results indicated little or no difference in survival between males and females and, calculation of survivorship varied minimally with methodology. Estimates represent minimum survival due the confounding effects of emigration.

GENETIC ORIGIN OF PEREGRINE FALCONS (*FALCO PEREGRINUS*) BREEDING IN CANADA

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Between 1975 and 1996, over 1500 captive bred Peregrine Falcons were introduced by hacking into nest sites in southern Canada. All the captive breeders originated from wild nests south of the treeline, considered to be within the range of the *anatum* subspecies. Some of the released falcons returned to breed in southern Canada, while others bred in the eastern US. Conversely, many of the peregrine falcons breeding in Canada originated from releases and wild sites in the US, where several subspecies were used in captive breeding programs. This is most evident in southern Ontario, where Peregrine Falcons resumed breeding in 1995 after an absence of over thirty years. From 1995 through 2004, 30 breeding adults were observed, of which nine were of Canadian origin, 12 of American origin, and nine were unbanded birds of unknown origin. However, of the Canadian birds, four had at least one parent originating from the US breeding program. This paper will review our knowledge of the origin of Peregrine Falcons that breed in Ontario and elsewhere in Canada, based on band recoveries.

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BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*) NATAL DISPERSAL IN THE UPPER PENINSULA OF MICHIGAN

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Nestling bald eagles have been banded in Wisconsin and Michigan since the early 1970's. Data on marked birds returning to natal breeding areas as breeding adults is scarce in North America. An auxiliary marking project using color bands with unique alpha-numeric codes was initiated in Michigan in 1989. Here we report on twenty-one (21) birds, ten males and 11 females with range in age from six (6) to twenty-five (25) years that were banded in Wisconsin or Michigan and are now breeding in territories in the western Upper Peninsula of Michigan. Natal dispersal distances for both sexes were $0 = 71.9$ km, range 14.2-309.0 km; for males, $0 = 84.0$ km, range 19.3-309.0 km; and for females, $0 = 60.8$ km, range 14.2-131.6 km. Dispersal direction was mainly north and east with a few south and none to the west.

THE KEY TO MAINTAINING HEALTHY FEET FOR RAPTORS IN CAPTIVITY

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Captive raptors are often maintained for conservation public display/programming. Presenting birds in excellent physical condition is imperative to offer an accurate and lasting impression to the public. While raptors have been maintained in captivity for hundreds of years, serious medical foot problems are often encountered. This paper will include a discussion focused on prevention of foot injury. Intercepting early foot lesions will be addressed. Tips on general husbandry, perch variations, perch covering and simple non-invasive methods to keep captive raptors in peak condition for their lifetime will be offered.

WESTERN GREAT LAKES REGION OWL MONITORING: RESULTS FROM 2005 AND PROSPECTS FOR A LONG-TERM PROGRAM

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Owls, due to their nocturnal courtship behavior, are poorly sampled using current long-term breeding bird monitoring programs. This makes it difficult to assess the population status and conservation needs for a whole suite of species. Beginning in the winter of 2004-2005, interested natural resource organizations in the Western Great Lakes region formed a group to design and implement a nocturnal monitoring survey for owls. The outcome was that a volunteer-based roadside survey using existing randomized survey routes would be conducted in northern Minnesota and in Wisconsin. The methodology incorporated was standardized from existing long-term nocturnal surveys in Canada in order to increase the scale of the monitoring

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program at a future date. Volunteers were asked to survey each route one time in Period 2 (21 March to 10 April); however, several volunteers conducted an additional survey in Period 1 (12 March to 20 March) and Period 3 (11 April to 24 April). In total, 131 survey routes were assigned to 105 volunteers. Of the 131 assigned routes (51 in Minnesota and 80 in Wisconsin), 43 routes (84%) in northern Minnesota and 56 routes (70%) in Wisconsin were surveyed at least once. Combined, volunteers recorded 205 detections of individual owls, consisting of seven species. The most abundant species detected were Barred owl (*Strix varia*), Northern Saw-whet owl (*Aegolius acadicus*), and Great horned owl (*Bubo virginianus*). The mean number of owls per survey in Period 2 was 1.85 for northern Minnesota and 1.13 for Wisconsin, and the mean number of owls per survey in Period 3 was 1.83 and 1.25 for Minnesota and Wisconsin, respectively. These results indicate that three species may be adequately monitored through this program to detect long-term changes in the Western Great Lakes. Additional routes, alternative methods, and larger spatial scales may be necessary changes in the future protocol to monitor certain species.

**EVALUATING GREAT LAKES BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*)
NESTING HABITAT WITH BAYESIAN INFERENCE**

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Bayesian inference facilitated structured interpretation of a nonreplicated, experience-based survey of potential nesting habitat for Bald Eagles along the five Great Lakes shorelines. We developed a pattern recognition (PATREC) model of our aerial search image with six habitat attributes: (a) tree cover, (b) proximity and (c) type/amount of human disturbance, (d) potential foraging habitat/shoreline irregularity, and suitable trees for (e) perching and (f) nesting. Tree cover >10%, human disturbance >0.8 km away, a ratio of total to linear shoreline distance >2.0, and suitable perch and nest trees were prerequisite for good Bald Eagle nesting habitat. The estimated probability of good habitat was high (96%) when all attributes were optimal, and nonexistent (0%) when none of the model attributes were present. Of 117 active Bald Eagle nests along the Great Lakes shorelines in 1992, 82% were in habitat classified as good. While our PATREC model provides a method for consistent interpretation of subjective surveyor experience, it also facilitates future management of Bald Eagle nesting habitat along Great Lakes Shorelines by providing insight into the number, type, and relative importance of key habitat attributes. This practical application of Bayesian inference demonstrates the technique's advantages for effectively incorporating available expertise, detailing model development processes, enabling exploratory simulations, and facilitating long-term ecosystem monitoring.

**NORTHERN GOSHAWK (*ACCIPITER GENTILIS*) MANAGEMENT IN MINNESOTA:
CAN SURVEYS, MONITORING OF PRODUCTIVITY, AND HABITAT ASSESSMENT
LEAD TO AN ASSESSMENT OF POPULATION SUSTAINABILITY?**

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A premise of forest management on state land in Minnesota is that native species will be sustained. The current strategy of integrating the habitat needs of Northern Goshawks in managing state lands consists of (1) maintaining at least 10% of the state land within a subsection planning area as old growth (2) lengthening the rotation of early successional forest harvest, and (3) protecting nesting and post-fledging areas within known goshawk territories and around newly discovered nests. Beginning in 2003, a 3-yr project was undertaken to increase the integration of goshawk habitat needs into forest planning and management. We collected data that described baseline habitat and goshawk population conditions in surveyed landscapes. Goshawks were surveyed in two contiguous forested areas in northeastern Minnesota, consisting of eight townships (737 km²) and 2.5 townships (230.4 km²) respectively. Historical territories were monitored every year for three years. Changes in forest structure and composition were analyzed for 15 territories. We will discuss how these results could be integrated into forest planning to better meet goshawk habitat needs. We will also discuss the limitations of such data for assessing the effects of forest management on sustainability of goshawk populations without more information on population distribution, density, and disturbance rates at broader spatial and time scales. We present a case for long-term monitoring and suggest a conceptual framework to address sustainability based in part on the experience gained from undertaking this 3-yr project.

**USING PRESENCE/ABSENCE SURVEYS TO ASSESS STATUS AND POPULATION
TREND OF RED-SHOULDERED HAWKS (*BUTEO LINEATUS*) IN CENTRAL
MINNESOTA**

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Forest-dwelling raptors are often difficult to detect because many species occur at low density or are secretive. Broadcasting conspecific vocalizations can increase the probability of detecting forest-dwelling raptors, and has been shown to be an effective method for locating and measuring raptor relative abundance. Recent statistical advances based on presence/absence data use probabilistic arguments to derive probability of detection and provide a model and

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likelihood-based method for estimating site occupancy rates when sites are visited ≥ 2 times. We used data from Red-shouldered Hawk call broadcast surveys conducted in central Minnesota in 1994-1995 and 2004-2005 to evaluate use of detection models to determine how occupancy estimates and detection probabilities differed (1) over multiple sampling seasons (years), (2) through time within sampling seasons, (3) in one year with the inclusion of covariates (call type and breeding stage), and (4) with different sampling strategies. Individual survey locations were visited 2-9 times within years, and parameter estimates of both probability of detection (range = 0.28 – 0.50) and site occupancy (range = 0.83 – 0.97) varied among years, through time in a single sampling season, and in one year with the inclusion of covariates. In 2004 and 2005, survey locations were randomly located throughout two landscapes, and we used results from these surveys to assess the affect of number of sample locations, double sampling, and discontinued sampling on parameter estimates. Estimates for probability of detection and proportion of sites occupied were similar across different sampling strategies, suggesting strategies for reducing sampling effort in a monitoring program. Our results indicate that presence/absence surveys may be useful for large-scale woodland raptor monitoring programs.

MEASURING THE EFFECTS OF WEST NILE VIRUS ON WILD AMERICAN KESTREL (*FALCO SPARVERIUS*) POPULATIONS IN COLORADO

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Since West Nile virus (WNV) was discovered in the United States in 1999, the disease has spread among bird populations in North and Central America, causing much concern over the long-term impacts of this disease on highly susceptible avian groups such as raptors. In 2003, Colorado led the nation in reported cases of WNV, with a three-fold increase in the number of reports of dead and dying raptors having WNV-like symptoms at wildlife rehabilitation centers. However, the prevalence of WNV among wild raptors, the severity of the immediate effects on individual birds, as well as the longer-term impacts of this disease at the population level among wild raptors, is not well understood. In 2004, the USGS began an investigation to assess the prevalence and potential effects of WNV on wild American kestrel populations along the Front Range of Colorado. We monitored nesting activity in 131 kestrel nest boxes from March to September 2004. Of the 74 active nests monitored, a total of 116 individual adults and 262 young were sampled throughout the breeding season for a total of 747 WNV samples. Virus culture failed to detect active WNV in serum (n = 612) and oral swab (n = 135) samples. However, 97.4% of the blood sampled adults captured in this study tested positive for WNV antibodies (suggesting prior exposure to the disease) while just 1.2% of blood sampled chicks tested positive for WNV antibodies (possibly through maternal antibody transfer). Preliminary breeding success data and results from our 2005 field season will also be discussed.

RED-SHOULDERED HAWK (*BUTEO LINEATUS*) NESTING BEHAVIOR AS DETERMINED BY TIME-LAPSED VIDEO CAMERAS IN WISCONSIN.

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We documented nesting activities at 10 Red-shouldered Hawk nests during 2003 and 2004 using time-lapsed video cameras in northeastern and central Wisconsin. Behavior during the nest building, incubation, and nestling stages were studied. At three nests, gender-specific behavioral differences were possible from marked individuals. Both adults contributed similarly towards nest building, but incubation and feeding young were dominated by females. Females did all of the nocturnal incubating and brooding of chicks. Video data documented cannibalism of live and dead young at nests. Preliminary results found small mammals and amphibians comprised approximately 70 % of the prey deliveries during the nestling period.

POPULATION GENETIC STRUCTURE OF A CIRCUMPOLAR SPECIES: THE GYRFALCON (*FALCO RUSTICOLUS*)

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Gyrfalcons are found in the circumpolar arctic and sub-arctic, breeding as far south as 55°N and as far north as 82°N in Greenland. Gyrfalcon populations are primarily distributed into six geographical areas: Alaska, Canada, Greenland, Iceland, Fennoscandia, and Siberia. Despite being large and mobile birds, no information exists on immigration or dispersal patterns of individuals over long distances or between geographical areas. In this study microsatellite and mitochondrial control region DNA (mtDNA) variation were used to investigate the phylogeographic structure of Gyrfalcon populations throughout a large portion of their range (Alaska, Canada, Greenland, Iceland, and Norway), including four sample locations within Greenland (Thule, Kangerlussuaq, Maniitsoq, and East Greenland). Saker Falcon (*F. cherrug*), a close relative of the Gyrfalcon, was used as an outgroup for comparison purposes. Significant population structure (F_{ST} , PCA, and assignment tests) was observed with microsatellite data between Gyrfalcon populations separated by large bodies of water (i.e., Greenland vs. Iceland), with the exception of Norway, while few comparisons were significant from locations on the same landmass (i.e., Alaska and Canada). In contrast, the mtDNA data revealed few significant relationships among Gyrfalcon populations. Out of eight observed mtDNA haplotypes, only two haplotypes were unique to a population (Iceland and Alaska) and three haplotypes were observed among sampling locations within Greenland, yet all haplotypes differed by only one to four nucleotides from a common haplotype shared by all surveyed Gyrfalcon populations. In all cases, however, significance was observed with both genetic markers when Gyrfalcon

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populations were compared to Saker Falcons. In conclusion, minimal genetic structure among Gyrfalcon sampling locations was observed within Greenland, yet significant genetic structure (microsatellite DNA) was observed between populations separated by large bodies of water. Gyrfalcons sampled in Norway were not significantly different from populations in Alaska and Canada possibly indicating connectivity across Siberia.

ARE THE BIRDS ENOUGH?

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The use of live birds for education is invaluable. But are the birds enough? Classrooms are becoming more diverse. Because of this educators must become more diverse. The birds are a wonderful attention grabber, but more resources maybe needed to help students, absorb, understand and retain information. Students rely upon their multiple intelligences to learn. For students, information may best be taken in through the verbal word, written word, visual, musical or kinesthetic arts. By combining the multiple intelligences educators can reach a wider range of students. Combining the intelligences greatly impacts a student's ability to absorb and retain information. By incorporating the multiple intelligences a stronger and richer program is created that reaches a diverse audience. Informative prepackets heighten students' educational experience. Study skins allow for physical contact and up close visuals. Bird quizzes use visuals for student assessment. Habitat perches create an accurate visual of animals in their natural habitat. Nature sounds invoke the mind to create a natural setting. Hands-on activities are one of the best ways to help students retain information. Posters and student packets left with the classroom provide verbal, visual and kinesthetic activities. Through combing the multiple intelligences with pre, during and post information and activities educators can stir interest in students and teachers and keep that interest thriving long after the program is complete.

BEYOND THE BIRDS: HABITAT

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Is teaching solely about the birds enough? It was not long ago that raptors had bounties on their heads, DDT was destroying raptor eggs, and if you did not hold tight to your child a raptor may carry it off. Due to the significant and necessary role that raptors play in the environment it is crucial to bring to the attention of the public the past, present and future perils these birds have had and continue to encounter. The number one reason for the endangerment of any species is habitat loss. As the American culture continues to grow, natural habitats shrink and are lost. By incorporating such topics into programs students receive knowledge on conservation issues important to the successful existence of raptors. Through the use of visual habitat perches, visual props and sounds students can gain a clear understanding of wildlife needs.

**SURVIVORSHIP ANALYSIS ON A POPULATION OF MARKED GALÁPAGOS HAWKS
(*BUTEO GALAPAGOENSIS*): ARE COOPERATING MALES BETTING ON A LONGER
LIFE?**

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Galápagos Hawks exhibit a rare mating system, cooperative polyandry, where one female and typically between two and four males live together on territories and cooperate in the rearing of young. During 1998-2004, we captured and marked 415 Galápagos Hawks on Santiago Island, Galápagos, Ecuador. Of these, 158 hawks were territorial adults of 33 groups, which enabled us to monitor reproductive success, group composition, and individual survival in an effort to understand the benefits and evolution of cooperative polyandry in this species. Of territories documented on Santiago Island (1999-2004), 84% were polyandrous with a mean of 2.4 males per group (Range = 1-6, $N = 174$ group-years). Our data reveal an intriguing paradox. Although polyandrous groups experienced greater nest success (85.4%, $N = 82$) than pairs (58.3%, $N = 12$), cooperating males seem to be at a severe disadvantage over the short term by producing a mean of 0.46 fledglings/male, relative to monogamous males (mean = 0.83 fledglings/male). However, polyandrous behavior persists and is, in fact, the norm. Our results are contrary to expectations from theory in which cooperating males should benefit over the long term by having higher fitness and greater lifetime reproductive success than monogamous males. Therefore, we hypothesize that group males may achieve fitness benefits by living longer than monogamous males. Here, we report the results of our Galápagos Hawk survivorship analysis relative to group size using Cormack-Jolly-Seber models and our resighting data for 158 marked territorial hawks on Santiago over a 6-yr period. This is, to our knowledge, the first detailed analysis of survival on a large tropical raptor based on a large sample of marked individuals.

POLYGYNY IN THE FLAMMULATED OWL (*OTUS FLAMMEOLUS*)

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As part of a long-term investigation of habitat and demography in Flammulated Owls in Colorado, we documented the first instance of polygyny in the typically monogamous species. In 2004, we discovered a polygynous male in a refuge-like parcel of forest within the boundary of the Hayman Fire, which burned the largest area (560 km²) in Colorado history in 2002. Chronologies at the male's two nests, which were 510 m apart, were separated by 12 days. Each brood initially contained three owlets, a brood size similar to the mean in monogamous nests. Evidence suggested that all owlets fledged from the primary brood, although the youngest sibling

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showed evidence of retarded development. In contrast, just one owlet fledged from the secondary brood, perhaps because of reduced male provisioning. The polygyny did not appear to be associated with abundance of lepidopterans (moths), their primary prey, or nest sites. One possible explanation is that the fire resulted in a female-biased operational sex ratio by decreasing the density of territorial male owls.

SEASONAL VARIATIONS IN THE DIET OF THE BARN OWL (*TYTO ALBA*) IN CENTRAL AND SOUTHERN PUNJAB, PAKISTAN

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Barn owl (*Tyto alba*) pellets were collected for three years from the main study area in central Punjab (n = 2360) and for a year from a southern district of Punjab (n = 256). An analysis of these pellets revealed that the barn owls of both these localities depended mainly on the house shrew (*Suncus murinus*) for their food which constituted 66% of their diet in the former and 59% in the latter locality. The house shrew was a staple food item in their winter diet at the former (79%) and latter (70%) localities, respectively, while it was the least consumed food item during summer (27%) at the former and during spring (48%) at the latter locality, respectively. This seasonal rise and fall in the abundance of shrew was attended by an inverse pattern of rise and fall in the abundance of rodents, birds and bats at the former, and by birds, rodents and insects at the latter locality.

SURVIVAL PROBABILITY OF MIGRATORY JUVENILE GOLDEN EAGLES (*AQUILA CHRYSAETOS*) FROM INTERIOR ALASKA

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The time between gaining independence and recruitment into a breeding population is one of the least studied periods of Golden Eagle life history. As a result, few empirically derived estimates of survival exist for Golden Eagles during this period of their life. We used satellite telemetry and program MARK to estimate the probability of survival of migratory juvenile Golden Eagles during their first year of independence in 1997 and 1999. Monthly survival probability during fall migration and early winter was 0.88 ± 0.04 (mean \pm SE) and 0.78 ± 0.05 for the 1997 and 1999 cohorts, respectively. Monthly survival probability during late winter, spring migration, and summer was 0.94 ± 0.03 for both cohorts. Survival probability during the first year of

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independence was 0.34 ± 0.10 for the 1997 cohort and 0.19 ± 0.07 for the 1999 cohort. Productivity, measured as the number of fledglings per territorial pair, was not a good predictor of first-year survival. Productivity was lower in 1997 (0.86) than in 1999 (1.00), but survival probability was higher in 1997 (34 ± 0.10) than in 1999 (0.19 ± 0.07). The probability of survival was constrained by brood-size; fledglings from single-chick broods were more likely to survive than fledglings from multiple-chick broods. Nesting territories that produce the greatest number of fledglings are often defined as the highest quality territories. However, our results suggest that low-production nesting territories may be as important for producing potential recruits to the breeding population as high production territories. The conservation and population assessment of Golden Eagles requires a thorough understanding of their demographic parameters. Low first-year survival rate, coupled with low reproductive rates, suggest that the population dynamics of the migratory population of Golden Eagles nesting in Denali may be considerably different than non-migratory or short-distance migratory populations nesting at lower latitudes in North America.

**SURVIVAL AND TIMING OF MORTALITY OF ADULT SWALLOW-TAILED KITES,
FIRST-YEAR SURVIVAL OF JUVENILES, AND THE POTENTIAL FOR SHORT-STOPPING
OF SUB-ADULTS ON THE NEWLY DISCOVERED WINTER RANGE OF AUSTRAL-
BREEDING CONSPECIFICS**

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Estimating annual survival and identifying sources of mortality are essential for describing population trends and conserving vulnerable species. We used satellite ($n = 19$) and VHF ($n = 25$) telemetry to estimate survival of adult Swallow-tailed Kites from the migratory U.S. breeding population. We categorized the status of each adult with which we lost radio contact based on the likelihood of mortality versus radio failure (e.g., signal loss during protracted water crossing in adverse winds probably indicated mortality). Four analytical scenarios from least (all losses attributed to mortality) to most (none attributed to mortality) conservative produced annual survival estimates of 0.61-0.84 (CIs~0.22). Losses were unevenly distributed across seasons and locations: 2 during breeding in the U.S., 10 on the winter range in South America, and 10 on south- or north-bound migration. First-year survival based on relocations at one year of over 120 VHF radio-tagged nestlings was 15-20%. Apart from mortality, one plausible explanation for this low detection rate is that some juveniles forego returning to their natal U.S. range during their pre-breeding years. To examine this possibility, we have begun a satellite-telemetry study to locate the wintering areas of kites from the austral breeding population in southern Brazil so that we can search for missing sub-adults marked as nestlings in the U.S. Although tentative, our estimates for annual survival will inform population-modeling. Knowing the timing and location of adult mortality will support conservation planning for the small U.S. population of Swallow-tailed Kites, which has not recovered from a severe contraction in range and number in the early 20th century. Besides addressing the short-stopping question, identification of the winter range

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of the austral breeding population contributes to our knowledge of the biology and conservation needs of this virtually unstudied sub-species of the Swallow-tailed Kite.

BEHAVIOR OF FLEDGLING COOPER'S HAWKS

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In conjunction with R.N. Rosenfield's ongoing research of breeding behaviors of Cooper's hawks (*Accipiter cooperii*) in urban areas of Portage County, Wisconsin, two male and three female nestlings were banded while in their nest tree on a residential lot in suburban Plover. Subsequently, beginning 6 wk 3 d after hatching, the post-fledging hawks were opportunistically observed over the next 26 d, their lengthy presence in this location due perhaps to the abundance of mammalian prey. The hawks were observed for 46.2 hr over 64 separate sighting periods: in solitary situations 14 times (22%), with two siblings interacting 17 times (27%), three hawks together in 16 instances (25%), four siblings 11 times (17%), all five juveniles together twice (3%), and four times (6%) with immature hawks present with the adult maternal Cooper's Hawk. The birds engaged in diverse behaviors of hunting, feeding, roosting, and other interactions. Some observations corroborated previously reported or opined juvenile hawk behaviors, but many other observed behaviors had not previously been reported in the paucity of literature regarding group behavior of immature Cooper's hawks. With detailed context, this narrative documentation reports hawks: successfully and unsuccessfully attacking prey, developing skills in hunting maneuvers, group foraging, physical confrontations and dominance-submission displays during competition for killed prey, sharing prey after a joint hunt, stealing food, taking young from a songbird nest, and non-hunting interactions with prey animals. This documented behavior of a group of immature birds for a relatively sustained period provides considerable reference data regarding the maturation of Cooper's hawks in this phase of their development. Moreover, the documentation is contemporarily significant because the observations occurred in a suburban environment typical of what has been determined over the last two decades to be commonly used habitat for this raptor.

DETERMINING THE ACCURACY OF USING MORPHOMETRICS TO SEX NESTLING BALD EAGLES (*HALIAEETUS LEUCOCEPHALUS*) IN THE GREAT LAKES REGION

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We investigated different techniques for sexing nestling Bald Eagles, a monomorphic species. Sexing Bald Eagles traditionally relies on using morphometric measurements. Two common techniques include sexing individuals based on (1) classification via a discriminant function model that uses the length of the hallux claw and bill depth (i.e., Bortolotti's equation) or (2) differentiation based on the length of the footpad, where footpad measurements below 135mm are determined to be male while those above are female. We explored the accuracy of using these morphometric techniques to sex nestling Bald Eagles and compare them to results from DNA testing. Since 1999, annual banding activities in Michigan and Minnesota have enabled us to sample a large number of Bald Eagle nestlings. We measured 128 nestlings and sexed each using Bortolotti's discriminant function model and the footpad measures. Based on the footpad measurement, 50% of the 128 nestlings were classified as females. In contrast, results from Bortolotti's equation resulted in 126 of 128 nestlings being classified as male. In order to explain the discrepancy between the two morphometric techniques, DNA testing was conducted to confirm sex. Preliminary DNA tests using blood suggest that footpad measures were a more accurate sexing tool to use in the field compared to Bortolotti's discriminant function model for our population of nestlings, but that DNA testing was the most accurate method to sex Bald Eagle nestlings.

RAPTOR ELECTROCUTION ON DISTRIBUTION POWER LINES IN SOUTHEAST ALBERTA, CANADA: AN INVESTIGATION OF MORTALITY RATES AT VARIOUS POWER POLE CONFIGURATIONS

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Avian mortality associated with power lines has been a persistent problem since power line development. While the issue of raptor electrocution has been extensively studied in many countries, very little research has been conducted in Canada. Utility companies interested in mitigating electrocutions cannot necessarily extrapolate results from other studies to their local service areas. In conjunction with ATCO Electric, the major utility in the province, I studied raptor electrocutions on distribution (< 69kV) power lines in southeast Alberta, Canada from 2003 – 2005. Two objectives of the research were to (1) identify which structures pose the greatest risk to raptors, and (2) quantify electrocutions not detected by the power company. Utility personnel often recover a carcass during power outage investigations. However, some carcasses go undetected during these investigations and furthermore, some electrocutions do not result in power interruptions and subsequent on-site investigations, resulting in a potential for under-reporting mortality. During the summer of 2003, 379 power poles were surveyed for evidence of electrocution, and rates of mortality at various power pole configurations were determined. Three-phase transformer poles and single-phase deadend structures were responsible for significantly higher mortality than other structures. An experimental assessment revealed that scavengers removed almost half of experimental carcasses within seven days.

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Based on this information, I estimate a loss of 542-2762 raptors to electrocution within the 13 400km² study area over a six-week period in the summer.

VARIATION IN REPRODUCTIVE INDICES IN THREE POPULATIONS OF COOPER'S HAWKS IN SOUTHWESTERN CANADA AND NORTHERN U.S.

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There is continuing concern for the long-term viability of Cooper's Hawk (*Accipiter cooperii*) populations across this species' broad North American distribution because of its designation as an area-sensitive, forest-interior species. Several US states list this species as threatened or as a species of special concern usually – as in population assessments of accipiters in Canada – without support of demographic data. There thus is a need for ecological information that may benefit conservation efforts on behalf of the Cooper's Hawk, efforts that may need to be targeted to specific populations that are presumably adapted to local/regional habitats. Our results show that indices for clutch size, brood size, and nest success differ significantly among or between three spatially and morphometrically diverse breeding populations of the Cooper's Hawk in British Columbia, North Dakota, and Wisconsin. We speculate about the ecological factors that may have lead to demographic variation and suggest that these three populations are exhibiting separate evolutionary trajectories. Our results underscore the need for further research on regional and other large-scale variation in avian demographic parameters to help decide if, when, and where population demographics may warrant a management response.

DIET, ACTIVITY PATTERNS, AND PREDICTABILITY OF MOVEMENT IN WINTERING ACCIPITER HAWKS

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Predator-prey studies focused on small wintering birds are common. However, our understanding of the dynamic interactions between such prey and their avian predators is greatly limited by our lack of knowledge about *Accipiter* hawks. Hence, we examined the predatory behavior of 40 Sharp-shinned Hawks (*A. striatus*) and 27 Cooper's Hawks (*A. cooperii*) using radio telemetry during the winters of 1999-2004. The diet of urban Cooper's Hawks was comprised almost entirely of prey over 70 g, which may leave small, urban prey free from

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predation. In contrast, the diet of Sharp-shinned Hawks was dominated by sparrow-sized prey (approximately 25 g), but generally did not include prey less than 20 g. Accordingly, Sharp-shinned Hawk activity was somewhat focused on feeders, while urban Cooper's Hawks largely avoided them. The daily use of space by both species was not significantly different from random based on a variety of spatial analyses, suggesting that *Accipiter* hunting strategies may be based largely on unpredictability. Temporally, the activity patterns of urban Cooper's Hawks were strongly bimodal and reflected the bimodal activity of their prey. In contrast, Sharp-shinned Hawk hunting activity peaked in the evening and was not coincident with prey activity. This difference may reflect the high risk of predation for Sharp-shinned Hawks by owls, the result of which may be to free small, rural prey from predation in the morning. Overall, our observations suggest that the behavior of Accipiters may have important implications for the activity of their prey.

BARRED OWLS (*STRIX VARIA*) IN AN AGRICULTURAL LANDSCAPE: FOREST LOSS, FRAGMENTATION AND GREAT HORNED OWLS (*BUBO VIRGINIANUS*)

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Barred Owls are mature forest associates that are common in relatively undisturbed old forest habitats. However, they also breed in the agricultural woodlots of north-central Alberta. The objectives of this two-year radio tracking study are to 1) compare the reproductive success and survival of barred owls in agricultural landscapes to areas of higher forest cover, 2) determine what habitat characteristics barred owls are selecting within both highly fragmented agricultural landscapes and more continuous forest landscapes, and 3) examine their interactions with Great Horned Owls, their primary predator, in both landscapes. This project is in its final year of field studies.

NORTHERN GREAT BASIN RAPTOR NEST SURVEY: PROJECT OVERVIEW AND PRELIMINARY RESULTS, 2000–2005

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In 2001, following three years of pilot surveys, HawkWatch International (HWI) conducted the first of an initial five-year annual, standardized survey of nesting raptors in northwest Utah. In 2004, we expanded the survey into northeast Nevada. The full survey area now encompasses roughly 4.5 million acres of northern Great Basin habitat and nearly 2,000 raptor and Common Raven (*Corvus corax*) nest sites. The focus is documenting the distribution, density, and productivity of diurnal raptors that nest on cliffs or in open woodland and shrubsteppe habitats characteristic of the Great Basin. Focal species include the Golden Eagle (*Aquila chrysaetos*), Prairie Falcon (*Falco mexicanus*), Peregrine Falcon (*Falco peregrinus*), Ferruginous Hawk (*Buteo regalis*), Swainson's Hawk (*B. swainsoni*), Red-tailed Hawk (*B. jamaicensis*), and

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Burrowing Owl (*Athene cunicularia*). The survey is a complete census of all suitable and accessible habitat within the survey region. Approximately 56% of the catalogued nest sites are on BLM land, 36% on private land, 7% on state lands, 1% on Sawtooth National Forest, and <1% on Hill Airforce Base. In 2004, the breakdown by focal species of numbers of occupied nesting territories was: Golden Eagles 84 UT / 35 NV; Red-tailed Hawks 49/53, Prairie Falcons 42/19, Peregrine Falcons 1/0; Swainson's Hawks 39/7, Ferruginous Hawks 38/36, and Burrowing Owls 33/17. The survey has spanned a multi-year, severe drought and the beginnings of recovery from that drought in 2004/2005, with nesting abundance and productivity trends clearly responding to annual and seasonal variations in rainfall distribution and habitat conditions. In the presentation, I will compare and contrast species-specific distribution and productivity patterns, discuss primary disturbance factors, and draw initial comparisons of productivity and abundance patterns with data from other similar surveys.

DETERMINING NORTHERN GOSHAWK (*ACCIPITER GENTILIS*) BREEDING AREA OCCUPANCY, NESTING ACTIVITY, AND REPRODUCTION IN NORTHERN MINNESOTA, 2003-2005

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Northern Goshawk (*Accipiter gentilis*) nesting and reproduction have been studied extensively in the western United States, but less is known about goshawks breeding in the Great Lakes region. We monitored goshawk breeding area occupancy, nesting activity, and reproduction in northern Minnesota during the breeding seasons of 2003-2005 using survey protocols based on those used for goshawks in the western U.S., but adapted for regional phenology and goshawk behavior. Standardized breeding areas assessments during courtship, and subsequent assessments later during the breeding season to assess occupancy and nest success were applied consistently during all three breeding seasons. We annually monitored historic breeding areas and investigated new breeding areas reported to us by collaborators, gathering information on an average of 60 breeding areas per year and a total of 86 breeding areas from 2003-2005. Goshawk nesting chronology in northern Minnesota was similar to that reported in Wisconsin and Michigan. The proportion of breeding areas annually occupied, determined by detection of a goshawk during ≥ 1 visit to a breeding area, was 0.66, 0.49, and 0.53 in 2003, 2004, and 2005, respectively. The proportion of breeding areas where egg laying was indicated was comparable to that of western goshawks, with breeding detected at 50, 44, and 44% of monitored breeding areas. The proportion of nesting areas that produced young, defined as detection of one or more goshawk chick after 1 June of each year, was 0.76 in 2003 and 0.60 in 2004. Predation was the cause of nest failure in a minimum of 12% of nests in 2003 and 16.7% of nests in 2004.

SEROLOGIC EVIDENCE OF WEST NILE VIRUS INFECTION IN THREE WILD RAPTOR POPULATIONS

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We assayed for West Nile virus (WNV) antibodies to determine the presence and prevalence of WNV infection in three raptor populations in southeast Wisconsin during 2003-2004. This study was conducted in the framework of ongoing population studies that started before WNV was introduced to the study area. For 354 samples, 88% of 42 adult Cooper's Hawks (*Accipiter cooperii*), 2.1% of 96 nestling Cooper's Hawks, 9.2% of 141 nestling Red-tailed Hawks (*Buteo jamaicensis*), and 12% of 73 nestling Great Horned Owls (*Bubo virginianus*) tested positive for WNV antibodies by the constant virus-serum dilution neutralization test. One adult Great Horned Owl and one adult Red-tailed Hawk also tested positive for WNV antibodies. Based on the increased prevalence and significantly higher WNV antibody titers in adults compared to nestlings, we suggest that nestlings with detectable antibody levels acquired these antibodies through passive transmission from the mother during egg production. Low levels of WNV antibodies in nestlings could serve as a surrogate marker of exposure in adult raptor populations. Based on breeding population densities and reproductive success over the past 15 years, we found no apparent adverse effects of WNV infections on these wild raptor populations. Further, we have no disappearance data from our long-term, mark-recapture studies on breeding adult Cooper's Hawks in Wisconsin that could serve as potential evidence of mortality due to WNV. Samples that tested positive for WNV antibodies were collected across a wide variety of habitat types including urban, roads, parking, recreational, cropland, pasture, grassland, woodland and wetland. Based on our data we were not able to determine whether or not certain nesting habitats are associated with higher risk for WNV exposure to raptors. A more complete analysis of habitat for nesting locations may be beneficial to understanding how different habitats and landscapes modulate WNV risks to wild raptor populations.

NESTING BIOLOGY OF URBAN COOPER'S HAWKS IN MILWAUKEE, WISCONSIN

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We studied an urban/suburban Cooper's Hawk (*Accipiter cooperii*) population in the metropolitan Milwaukee area over a 12-year period. Reproductive success for 254 first nesting attempts averaged 64.5% nest success with an average of 2.27 young per active nest and 3.53 young per successful nest from 1993 to 2004. Productivity did not vary significantly over the 12-year period. For eight re-nests (i.e., second nesting attempts), nest success averaged 87.5% with an average of 2.57 young per active nest and 3.00 young per successful nest; productivity

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for re-nests was not significantly different than first nesting attempts. We documented evidence of nest predation by raccoons (*Procyon lotor*), Red-tailed Hawks (*Buteo jamaicensis*) and Great Horned Owls (*Bubo virginianus*). On average, over the 12-year period, SY (i.e., juvenile) Cooper's Hawks comprised 14.6% (43 of 295; 37 of 172 [21.5%] females and 6 of 123 [4.9%] males) of the breeding population. The percentage of SY breeders within this population appears to be declining, suggesting a relatively young population. We trapped 105 breeders and documented five natal dispersals. Based on relatively high reproduction and confirmed recruitment, we suggest that this urban Cooper's Hawk population may be a source population.

DETERMINING APPROPRIATE LANDSCAPE SCALE FOR HABITAT DESCRIPTION AND ANALYSES, AND PRELIMINARY LANDSCAPE SELECTION PATTERNS FOR TWO RAPTOR SPECIES

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A detailed description of a species' habitat can help explain relationships between the species and its environment, and can be used for management and conservation purposes. Using the appropriate scale or scales to describe habitat is critical. We used a multi-scale GIS approach (ten concentric buffer rings) to describe land-cover patterns surrounding nest sites for two raptor species, Red-tailed Hawks (*Buteo jamaicensis*) and Cooper's Hawks (*Accipiter cooperii*), and to determine the appropriate scales for more detailed habitat analyses. We also compared these landscape selection patterns to random sites within each study area. Based on random sites, variations in scale can affect landscape characteristics such as perimeter length and the number of patches probably because of patch configurations. However, these variations apparently do not affect land-cover area for vector-based data. Both Red-tailed Hawks and Cooper's Hawks appeared to select for woodlands and wetlands (wetlands to a lesser degree for Cooper's Hawks) closer to nest sites. While the area of urban habitat decreased at smaller scales for Cooper's Hawks, it still comprised a major portion of habitat near nest sites. Based on the variations in land-cover composition at increasing distances from nest sites, one to three different scales should be adequate to describe landscape-scale features and to address most research questions. We suggest that for Red-tailed Hawks, 100, 250, and 1000 m-radius circular plots and for Cooper's Hawks, 50, 200, and 500 m-radius circular plots are appropriate scales to describe nest area, macrohabitat, and landscape, respectively. We suggest that this multi-scale GIS approach can be used to determine the most appropriate scale or scales for more detailed analyses that describe habitat associated with any taxonomic group at any focal point (e.g., den, nest or perch site).

EXAMINING THE EFFECTS OF ADULT FEMALE BODY CONDITION MANIPULATION ON NESTLING SEX RATIOS IN BURROWING OWLS (*ATHENE CUNICULARIA*)

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To maximize their offspring's future reproductive success, some species of animals alter offspring sex ratios according to their own physical condition at the time of reproduction, which is in accordance with evolutionary theory (Trivers and Willard 1973). Our study manipulated adult female body condition in Burrowing Owls to examine potential effects on nestling sex ratios in the Snake River Birds of Prey National Conservation Area, Idaho during two breeding seasons (2003-2004). We improved adult female condition at 15 nests by providing supplemental food during the breeding season. Body condition of adult females was decreased at 10 nests by clipping 3 cm off the tips of four primary feathers, which in effect made it energetically more costly for flight. Control nests (n = 13) were visited an equal number of times as treatment nests but otherwise were not manipulated. We determined sex of 228 nestling burrowing owls from focal nests using DNA isolated from blood and a standard protocol involving PCR amplification of the CHD-1 gene found on avian sex chromosomes. After controlling for brood size, there was no effect of body condition treatments on nestling sex ratios. Longer-term data (1997-2004) from this same population suggest that non-manipulated Burrowing Owls also do not alter nestling sex ratios in relation to the body condition of adult females. While there was a significant positive correlation between offspring and adult female body condition at 186 nests during this time period, adult female body condition did not correlate with nestling sex ratio. Therefore, neither the longer-term or two-year experimental results suggest that Burrowing Owls manipulate offspring sex ratios according to adult female body condition.

CASTING THE PARTS FOR A RAPTOR FREE FLIGHT PROGRAM: FROM DESIGN TO DEMONSTRATION

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One of the most popular programs offered to visitors at the Arizona-Sonora Desert Museum is the Raptor Free Flight (RFF), a bird demonstration conducted in open desert. Unlike traditional bird shows, where trainers and narrators are as much in focus as the animals, the RFF emphasizes the birds and their habitat. Building a natural program requires careful selection of all parties to ensure success. Individual birds are selected based on their personal history to ensure each one will be physically and psychologically best suited to the rigors of daily life in an educational program. Training for each bird is specialized considering antecedents, species, and long-term goals for the bird. Daily schedules for birds include exercise time without visitors, training time with trainers, training sessions with volunteers, and demonstration time for visitors. Program volunteers are selected based on skills, ability to work in a team, endurance, and desire to place the birds at the center of attention. Both bird handlers and narrators are volunteer

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positions that require an enormous time commitment at and away from the Museum. Volunteers are expected to attend training classes as well as one-on-one training and complete evaluations regularly. To conduct two flight demonstrations daily, from November through April the program utilizes five to six volunteers a day and one or two paid staff. Training staff invests time in broadening their bird training skills and their mentoring skills for both groups of volunteers. When the birds, volunteers, and trainers work together, the program showcases native birds. Visitors have the opportunity to see bird behaviors up close like gliding, stooping, back standing, vocalizing, mantling, supplanting, rousing, among others. Visitors leave with an up-close view of the birds and a glimpse into the wild and amazing lives of raptors in the Sonoran Desert.

RAPTOR HANDLING AND BASIC ANIMAL TRAINING FOR ADULT VOLUNTEERS

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The Arizona-Sonora Desert Museum has several volunteer positions, which involve adults handling, or training native raptor species. Volunteer positions vary from strictly handling raptors for interpretation, to handling them for exercise and care, to actually free flying the birds with trainers for the Raptor Free Flight (RFF) demonstration. Adult volunteer training programs vary based on the expectations of the handler. For example, the volunteer docents who handle the birds for interpretation are required to attend multiple classes with inquiry-based activities, multiple training sessions with a staff trainer, practice sessions without a trainer, and ultimately docents must complete a written and practical certification given by a staff trainer. The docents work with their birds at least once every other week but ideally each week that they volunteer, they take their bird out for interpretation on grounds or a practice session. The RFF volunteers work with the birds for an eight-hour day once a week and work side by side with a trainer for eight weeks to prepare for flight demonstrations. The volunteer training program relies on adult learning theory as the foundation, recognizing that each volunteer comes with a different level of valuable experience and learning style. Volunteers progress to tasks at different paces, but each volunteer must be able to handle at least half the birds in the program with all associated tasks (i.e. weighing, boxing, jessing and unjessing, luring, etc.). Volunteers must maintain certifications and be open to constructive criticism from staff and other volunteers. At times volunteers do not always agree with policies, but must understand that the program is designed around the birds' needs as the top priority.

BIRDS OF PREY PROGRAMS AT BOYD HILL NATURE PARK IN ST. PETERSBURG, FLORIDA

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Boyd Hill Nature Park is an 800 acre complex of natural ecosystems located in the midst of an urban landscape. It is owned and operated by the City of St. Petersburg. Its 10 km of trails winds through marsh, hammocks, and upland pine flatwoods providing a natural classroom for the Park's naturalists/rangers. In 1987 the first three permanently injured/non-releasable birds of prey were acquired. We have since expanded to 11 representatives of 7 species that act as "teaching assistants" for park staff who provide onsite avian education programs for several thousand Pinellas County school children who visit the park annually and for participants in the Park's Summer Nature Day Camp. School year programs for grades three, four, and five are designed to introduce bird basics, e.g. their unique characteristics, identification, behavior, and ecology. Prior to the visit, teachers are given a packet that contains a program outline, glossary, pre and post-tests, and species outlines for ID and coloring and are asked to introduce the students to the glossary. Once on site, concepts such as niche, habitat preference and partitioning, ongoing threats, and the problems with imprinting are covered along with hands on activities; e.g. use of binoculars, field guides, housing construction, and keeping a notebook. Summer camp attendees do not receive the pre and post-tests but cover the basic ecological concepts noted above and the role of raptors as indicators of ecosystem health. Our arrangement of birds in the aviary is designed to assist in supporting concepts such as day-night habitat partitioning and competition for resources. Bio-artifacts such as feathers, bones, skulls, and feet/talons are used to introduce the students to the adaptations that birds, and raptors in particular, have made that allow them to fly fast or silently and to hunt successfully.

LONGEVITY AND PHILOPATRY IN FLORIDA BALD EAGLES

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During 1987-1991, we banded 140 nestling Bald Eagles (*Haliaeetus leucocephalus*) at nests throughout north-central Florida. Over the years since then, several of these individuals have been recovered, some in close proximity to their natal nest. Band recovery data were requested and obtained from the USFWS Bird Banding Laboratory. I compared banding and recovery dates to examine longevity of the individuals recovered. Additionally, I compared the banding location (natal nest) with the recovery location to gain additional insights into philopatry in Bald Eagles.

ECOLOGY OF FLAMMULATED OWLS IN BOISE NATIONAL FOREST, IDAHO

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Flammulated Owls are small owls of western pine forests whose status is of concern for two reasons: limited knowledge about their biology, and heavy anthropogenic manipulations of their breeding habitat. To help understand potential effects of timber harvest and other manipulations of the forest, we are studying the ecology of Flammulated Owls in portions of the Boise National Forest slated for future timber harvest. We used radio telemetry to monitor adult and juvenile Flammulated Owls (*Otus flammeolus*) during the nesting season in ponderosa pine (*Pinus ponderosa*) /Douglas-fir (*Pseudotsuga menziesii*) forest 80 km north of Boise, Idaho. We determined home ranges and assessed vegetation to evaluate habitat use. We documented day roosts, calling trees, and foraging areas. We located nests and monitored breeding chronology and rates of nest success. We also describe owl movements during the nesting, post-fledging, and dispersal periods.

HOW TO PACK 25 5TH GRADERS WITH YOUR RESEARCH GEAR AND WHY YOU SHOULD

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Raptors are charismatic creatures that capture the public's attention and serve as a useful tool in teaching environmental, conservation, and biological principles. As raptor biologist, we have a unique opportunity to use our biological understanding and field experiences to segue between scientific research and education beyond that of the typical graduate/undergraduate experience. In particular, graduate students, because of their age and intermediate position between young students and professionals, are particularly well suited to conducting non-traditional, public education. Here we present an example of an educational outreach program we conducted that utilizes the unique experiences and biological education gained through graduate-level raptor studies to enrich an elementary school science curriculum. Through classroom presentation, slide shows, hands on materials, letters, emails, and satellite phone calls between field researchers and students, elementary students had the opportunity to experience the excitement and education of scientific discovery first hand. Goals of this project were to teach students about goal setting, basic biological principles, study organisms, and the geography, people, and cultures of our national and international study areas (Greenland, Wisconsin, and Alaska). Benefits of such researcher-induced elementary outreach programs include: 1) Introduces students to science in an exciting, non-intimidating, and personal manner that can spark long-term interest and curiosity; 2) Bolsters students' world view by exposing them to foreign cultures; 3) Furthers student learning in reading, writing, and problem solving skills; 4) Provides students a positive academic role model; 5) Increases the public's understanding and value of basic biological concepts and natural resources; 6) Improves research grant

competitiveness by fulfilling broader impact criteria; and 7) Offers researchers a refreshing perspective on scientific endeavors.

ROADWAY MORTALITY OF RAPTORS IN SOUTHERN IDAHO

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Especially in North America, we know little about what appears to be an increasingly serious wildlife conservation issue: mortality of raptors along highways. Roadway mortality is considered the leading cause of direct mortality of wildlife in North America, surpassing hunting in the 1960s. We are (1) quantifying raptor mortality along an interstate highway in southern Idaho, including portions that traverse the Snake River Birds of Prey National Conservation Area, and (2) gathering information on seasonal trends, documenting which species, ages, and sex classes are involved, and analyzing cover type and geographic features within the median and adjacent areas of highways of locations where raptors are being killed. Our study will provide the basis for future studies to experimentally investigate treatments to mitigate "mortality hotspots". Beginning in July 2004, twice per month we surveyed a 250-km portion of Interstate 84, which traverses grasslands, rangelands, and croplands of southern Idaho. Surveys (n = 22 to date) located an average of 9.3 dead raptors per survey representing 10 species. Barn Owls (*Tyto alba*) were most numerous (n = 150, range = 2 – 30 per survey). Barn Owls may be most susceptible to roadway mortality because of attraction to agricultural areas along the roadway, their use of roadways during winter months, or other reasons.

PREVALENCE OF WEST NILE VIRUS IN PEREGRINE FALCONS (*FALCO PEREGRINUS*)

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Since West Nile virus (WNV) was discovered in New York City, New York in 1999, it has quickly spread throughout the continental United States, much of Canada, central America and the Caribbean. Yearly outbreaks of this disease have continued into 2005 causing mortality in tens of thousands of wild birds and likely will never disappear from the western hemisphere. Morbidity and mortality from WNV has been reported quite commonly in raptors, especially in Ohio in 2002 and then again in Colorado in 2003, but little is known about the impact or prevalence of this disease in this group of birds. In 2001 we initiated a study to determine the prevalence of specific WNV neutralizing antibody in Peregrine Falcons during migration at Assateague Island, Maryland and Virginia (fall only), and South Padre Island, Texas (spring and fall). Peregrine Falcons have been monitored through observation and banding for 35 and 28 years respectively at these two locations. From fall of 2001 through the spring of 2005 more

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than 650 blood samples have been tested by PRNT for WNV antibody. Prevalence of antibody has increased from 2.0% in fall 2001 to 14.7% in spring of 2005. During 1999-2004 capture success and observations have declined when compared against the 10-yr average 1988-1998 at Assateague Island, however, this decline can not be directly attributed to WNV based on our data. Results from this study reflect the increasing prevalence of WNV throughout North America. Based on our data continued monitoring and research are warranted.

MORPHOMETRICS OF ADULT TUNDRA PEREGRINE FALCONS IN RANKIN INLET, NUNAVUT, CANADA

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We present summary statistics of body weight, wing chord and tail length of adult male and female tundra peregrine falcons in Rankin Inlet, Nunavut, Canada. Average body without accounting for time of year was 954 ± 78 grams and 611 ± 40 grams for females and males respectively. Average wing chord was 362 ± 7 mm for females and 317 ± 5 mm for males. Average tail length for adult female and male tundra peregrines was 164 ± 7 mm and 139 ± 6 mm respectively. A statistically significant decrease in body weight over the course of the breeding season in both males and females is evident. Preliminary analysis indicates that average body weight of female peregrine falcons decreased from 981 ± 79 grams in spring to 924 ± 73 grams in summer (one tailed T-test, $p = 0.0004$). In addition, average body weight of male peregrine falcons decreased from 622 ± 39 grams in spring to 599 ± 37 grams in summer (one tailed T-test, $p = 0.04$).

FIFTY-TWO YEARS (1952-2004) OF BAND RECOVERY DATA OF SHARP-SHINNED HAWKS (*ACCIPITER STRIATUS*) AT CEDAR GROVE ORNITHOLOGICAL STATION, CEDAR GROVE, WISCONSIN USA.

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Cedar Grove Ornithological Station (CGOS) researchers have studied several aspects of raptor migration. This poster summarizes Sharp-shinned Hawk band/recovery data obtained from the Patuxent Bird Banding Laboratory, presents estimates of survival rates, and highlights a recent study of the natal origins of immature Sharp-shinned Hawks trapped in 1999. Of the 102,629 Sharp-shinned Hawks observed at CGOS from 1952-2004, a total of 18,571 were banded, yielding an 18% trap rate. During this time period, 310 banded Sharp-shinned Hawks were encountered, including 219 (73%) female and 195 (64%) immature birds. Interestingly, 139 (46%) were immature females at the time of banding. The longest time period between banding and recovery was twelve yrs. Literature regarding the longevity and natal origins of this species is scarce. Using Program MARK, we were able to estimate survival rates based on live recapture and dead recovery data. Stable-hydrogen isotope analysis suggests that most immature Sharp-shinned Hawks hatched in the Great Lakes region migrate past CGOS earlier than those from more northern/northwestern natal origins (Coleman, 2004). This project shows that data from long-term banding/recovery efforts from research stations such as CGOS can provide critical information about migratory raptors.

SATELLITE TRACKING BALD EAGLES (*HALIAEETUS LEUCOCEPHALUS*) IN THE UPPER MIDWEST

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People have long speculated about Bald Eagle migration routes between summer and winter ranges in the Upper Midwest. With the recent advent and rapid refinement of satellite telemetry such information can be obtained in a more reliable, accurate, and timely fashion than was previously available through band returns. In a joint effort, personnel from The Raptor Center at the University of Minnesota and Kohler Company/Kohler Trust for Preservation of Kohler, Wisconsin, began capturing eagles in Glen Haven, Wisconsin, primarily by rocket-netting over animal carcasses. During the winter months from March 1999 through February 2002, ten transmitters were fastened to eagles. All but the first were fitted to adults. Five were powered by conventional lithium batteries with a predicted longevity of one and one-half to two years and five were equipped with solar cells enabling the batteries to be recharged for over three years. Two transmitters ceased to provide usable information after only six and 11 weeks of operation, yet three yielded data for over three years, one of which is well into the sixth year. Kohler personnel deployed two additional solar-powered transmitters in the winter of 2004-05. Location information has revealed eagle winter ranges as far south as the Illinois River southwest of Springfield, Illinois and summer ranges as far north as Arviat, Nunavut (formerly Eskimo Point, Northwest Territories), on the west shore of Hudson Bay. Straight-line distances between the cores of an eagle's winter and summer range were as little as 592 km for some to as much as 2287 km for others. Some eagles were mobile on summer and/or winter ranges while others

were more stationary. Eagles with multiple years of data varied in their fidelity to migration routes and timing.

GREAT GRAY OWLS (*STRIX NEBULOSA*) NESTING IN NORTHEAST WISCONSIN

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Great Gray Owls are rare summer residents in northern Wisconsin. The first documented nesting for the state was in Ashland County in northwestern Wisconsin in 1988. Historic summer records in our study area, in northeastern Wisconsin, date back to the 1960's. Nesting was suspected in the study area in 1979 and 1980. We observed our first Great Gray Owl in June 1992. We were able to confirm successful nesting in five out of the last six years at two different territories. Both nesting territories are in similar habitat and incorporated old and active Northern Goshawk (*Accipiter gentiles*) nests. Great Gray Owl and Northern Goshawk have successfully fledged young while nesting within 150 meters of each other on two occasions. Mammal prey for the owls included both upland and lowland conifer species. Fisher (*Martes pennanti*) has been the cause of mortality in both adult and young owls.

PEREGRINE FALCONS (*FALCO PEREGRINUS PEALEI*) BREEDING BIOLOGY ON KIIS GWAI (LANGARA ISLAND)

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The Peale's Peregrine Falcons nesting at Kiis Gwaii (Langara Island) in the Queen Charlotte Islands, British Columbia, Canada, were reported by various authors beginning with Green (Ibis, 1916), and were investigated in 1952–1958 by Beebe (Condor, 1960). This poster highlights some findings of my studies that began with long field seasons in 1968–1973 to document breeding behaviour, the adults' contribution to eggshell breakage, and territorial activities, and 8–10 d visits from 1974 onwards to document occupancy, productivity, lifetime reproductive success, and other aspects. The island is at 54°N, and is about 9 km X 6 km with numerous coastal cliffs. The falcons feed almost exclusively on Ancient Murrelets (*Synthliboramphus antiquus*). In the 1950s the island held 20+ pairs. In 1968-2005 the island held 5 ½ to 10 pairs, usually about seven, much reduced because of a major decline in the island's very large seabird prey base. Introduced rats collapsed the murrelet population, but were poisoned in 1995–1996 by the Canadian Wildlife Service, and the murrelets appear to be slowly recovering. The falcons appear to be capturing murrelets that are commuting and foraging within efficient hunting range of Langara Island but are mostly nesting 40 and 55 km away at large murrelet colonies. Since 1980, more than half of the territorial falcons have been individually identified each year by face markings. Survival of adults is about 70% for males and 64% for females. The average breeder accomplishes three breeding efforts and produces 5.8 banding-age nestlings. Fifty percent of the nestlings are reared by only 20% of the breeders. Fluctuations in adult survival, nesting

phenology, and productivity appear to be related to vagaries in the severity of winter weather, spring weather, and ocean temperature and productivity, aspects that await detailed analysis.

ANGER MANAGEMENT: THE BEHAVIOR OF TERRITORIAL BARRED OWLS (*STRIX VARIA*) IN RESPONSE TO CONSPECIFIC INVASION.

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The behavior and vocalizations of territorial adult Barred Owls during interactions with a simulated conspecific intruder will be described. A live female decoy was used to simulate an intruder in the territory. Vocalizations from owls that frequently swooped above the intruder and those that swooped less frequently were different, but were consistent within these two groups. Two vocalizations that have not been described in the literature were consistently observed during aggressive behavior. Observations suggest a dichotomy in the roles of the sexes during territorial interactions.

PRIMARY AND SECONDARY POISONING OF RAPTORS BY RODENTICIDES IN THE UNITED STATES

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Numerous avian and non-target mammalian species are primary and secondary poisoning victims of rodenticides. Rodenticides are widely available and used worldwide for control of commensal and field rodents. Continued registration of nine of the most widely used rodenticides currently is under review by the EPA. Risk estimates (based on available exposure and effects data) exceed the EPA's levels of concern for these compounds. High acute toxicity of these rodenticide baits, particularly 2nd generation anti-coagulants (ACRs), is of major concern; they were designed to kill small mammals in rapid fashion, many are lethal following one exposure, many baits contain ingredients that attract non-target mammals, and predators and scavengers are attracted to the dead or dying rodents or non-target organisms. There is substantial lab and field evidence of mortality and morbidity of avian species, particularly raptors, exposed to rodenticides (baits or poisoned prey), and retention times of residues in body tissues are of great concern because they are so persistent. Numerous reported incidents indicate that exposure to one or more rodenticides is occurring in many raptor species, including both predators and scavengers. The EPA's EIIS database reveals almost 400 wildlife mortality incidents in which one or more rodenticide was detected. This includes 255 incidents for brodifacoum alone (n=152 birds, 121 raptors), although other rodenticides (bromadiolone, diphacinone, warfarin) are listed as mortality factors as well. For raptor species, great-horned owls and red-tailed hawks are the most commonly reported to the database and thus appear to be the most common victims of rodenticides, but many other species of hawks, eagles, owls, and vultures are represented. Of major concern is the fact that this database is only the tip of the

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iceberg when it comes to detecting raptor mortality due to rodenticide exposure. There is great concern regarding impacts on certain raptor species, specifically species protected under the ESA such as bald eagles and spotted owls. The apparent epidemic of primary and secondary rodenticide poisoning seen in raptor species in the US was examined and will be discussed in relation to the EPA's current re-registration review.

EFFECTS OF RADIO MARKING ON PRAIRIE FALCONS: ATTACHMENT FAILURES PROVIDE INSIGHTS ABOUT SURVIVAL

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From 1999-2002, we attached satellite-received platform transmitter terminals (PTTs) to 40 adult female Prairie Falcons (*Falco mexicanus*) on their nesting grounds in the Snake River Birds of Prey National Conservation Area (NCA) in southwest Idaho. We used three variations of a backpack harness design that had been used previously on raptors. Each radio-marked falcon also received a color leg band with a unique alphanumeric code. We monitored survival of birds using radiotelemetry, and we searched for marked birds on their nesting grounds during breeding seasons after marking. The fact that six falcons removed their harnesses during the first year allowed us to compare survival rates of birds that shed PTTs with those that retained them. We describe a harness design that failed prematurely as well as designs that proved successful for long-term PTT attachment. We re-sighted 21 marked individuals on nesting areas 1-5 years after they were radio marked, and we documented 13 mortalities of satellite-tracked falcons. We used a Cormack-Jolly-Seber model to estimate apparent survival probability based on band re-sighting and telemetry data. PTTs had no short-term effects on falcons or their nesting success during the nesting season they were marked, but birds that shed their transmitters increased their probability of survival. Estimated annual survival for birds that shed their transmitters was 87% compared to 49% for birds wearing transmitters. We discuss possible reasons for differences in apparent survival rates, and we make recommendations for future marking of falcons.

**REGIONAL AND TEMPORAL VARIATIONS IN PREY SELECTION OF NESTING
GOLDEN EAGLES (*AQUILA CHRYSAETOS*) IN JAPAN**

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We examined regional and temporal variations in prey selection during the nestling period of Golden Eagles in Japan. We conducted direct video recordings of a pair of Golden Eagles in Akita prefecture as they delivered prey to the nest for two consecutive nestling periods. We also assembled data from previous studies in Japan, eventually obtaining 14 data sets with which we compared prey composition during nestling periods. Among them, four sets of data were recorded daily by video and used to investigate the temporal change in prey selection and the amount delivered to the nest. The prey item composition varied considerably among the data sets. That variation was characterized by the difference in the proportions of Japanese Hare (*Lepus brachyurus*), snakes, and Copper Pheasant (*Syrnaticus soemmerringii*). A correlation analysis between the dietary breadth determined by the prey composition and the proportion of Japanese Hare showed a strong negative relationship, in contrast to a positive correlation shown for dietary breadth and the proportion of snakes or Copper Pheasant. The proportion of Japanese Hare correlated negatively with that of snakes and that of Copper Pheasant. Temporal change in prey selection during nestling periods showed marked variation, but similarities were found in later deliveries of snakes and in total prey weights (83.7 – 89.9 kg) of successfully fledged cases. Taken together, our results suggest that prey specialization of Golden Eagles during nestling periods in Japan occurred on Japanese Hare. Dietary breadth increased through feeding predominantly on snakes, a temporarily available prey, to satisfy the breeding dietary requirement. Regionally varied temporal prey selection may be a key factor for sustaining eagle populations in the forested mountain habitats of Japan, where prey and habitat conditions change dramatically during breeding season.

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