

ABSTRACTS OF PRESENTATIONS MADE AT THE ANNUAL MEETING OF THE
RAPTOR RESEARCH FOUNDATION, INC., HELD AT
TULSA, OKLAHOMA, ON 6-10 NOVEMBER 1991

ACKNOWLEDGMENTS

The Raptor Research Foundation, Inc., gratefully acknowledges financial and other support which helped immensely in making the meeting a success. Support was provided by: Mohamed Al-Salhi, Amir's Persian Imports, The Bartlesville Audubon Society, The Indian Nations Audubon Society, Nature Conservancy Oklahoma Chapter, Oklahoma Biological Survey, Connors State College Biology Club, Tim Jessell Artist, Oklahoma Department of Wildlife Conservation, Oklahoma Falconer's Association, Mary K. Oxley Nature Center, Phillips Petroleum Foundation, Public Service Company of Oklahoma, Ken Riddle, Sutton Avian Research Center, The Tulsa Audubon Society, The Tulsa World, The Tulsa Zoo, The U.S. Fish and Wildlife Service, Tulsa office, West of Boston, The Williams Companies, Inc., and Sally Ann Wormley.

ORGANIZING COMMITTEE CHAIRPERSONS

M. Alan Jenkins, Scientific Program Chairperson, G.M. Sutton Avian Research Center, P.O. Box 2007, Bartlesville, OK 74005

Ms. Keven Colbert, Local Committee Chairperson, G.M. Sutton Avian Research Center, P.O. Box 2007, Bartlesville, OK 74005

ORAL PAPERS

THE STATUS REVIEW AND RECLASSIFICATION PROCESS OF THE PEREGRINE FALCONS IN NORTH AMERICA

AMBROSE, R.E. AND T.R. SWEM. *Endangered Species, U.S. Fish and Wildlife Service, 1412 Airport Way, Fairbanks, AK 99701*

The U.S. Fish and Wildlife Service is reviewing the status of the Arctic Peregrine Falcon (*Falco peregrinus tundrius*) and American Peregrine Falcon (*F. p. anatum*) in northern North America. The Arctic Peregrine Falcon is currently listed as threatened and the American Peregrine Falcon is listed as endangered. The Service published a Notice of Status Review in the Federal Register on 12 June 1991. Information and comments received to date indicate overwhelming support for the "delisting" of both populations. A review of all information and a decision on reclassification will be made by early 1992. Any proposed rule (status change) will be published in the Federal Register.

FEEDING AND REPRODUCTIVE ECOLOGY OF SYMPATRIC BUTEONINE HAWKS IN SOUTHEASTERN COLORADO

ANDERSEN, D.E. *Minnesota Coop. Fish and Wildlife Research Unit, Dept. of Fisheries and Wildlife, University of Minnesota, St. Paul, MN 55108*

From 1983-88 I studied the feeding and reproductive ecology of Red-tailed (*Buteo jamaicensis*), Ferruginous (*B. regalis*), and Swainson's Hawks (*B. swainsoni*) in southeastern Colorado. Diet breadth was greatest for Red-tailed Hawks ($B = 4.64$) and lower for Ferruginous (2.82) and Swainson's (2.65) Hawks. Diet overlap was highest between Ferruginous and Swainson's Hawks ($O = 0.729$), intermediate between Red-tailed and Swainson's Hawks (0.290) and lowest between Red-tailed and Ferruginous Hawks (0.220). Reproductive success was highly variable for Ferruginous ($\bar{x} = 0.55$, $CV = 0.386$) and Swainson's Hawks ($\bar{x} = 0.64$, $CV = 0.341$) and less variable and higher for Red-tailed Hawks ($\bar{x} = 0.73$, $CV = 0.263$). These observations reflect divergent life history strategies among these congeneric species.

HABITAT USE BY BREEDING GOSHAWKS IN THE SOUTHERN CASCADES

AUSTIN, K. *Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR 97331*

Management of breeding Northern Goshawk (*Accipiter gentilis*) habitat in Region 5 of the U.S. Forest Service consists of retention of a 50-100 acre forested nest buffer, and research is needed to evaluate and expand management guidelines. Radiotelemetry conducted during the breeding season of 1988 and 1989 indicates an average home range area (95% minimum convex polygon) of 1891 ha (4670 ac) for 10 goshawks (5 males, 5 females). Analysis of vegetation data, from radio-telemetry sites and random sites in home range areas, indicates that goshawks selected the oldest, densest vegetation type available, and avoided the youngest, and most open vegetation.

NESTLING DIET IN COOPER'S HAWK

BIELEFELDT, J., R. ROSENFELD AND J. PAPP. *Racine County DPW, Sturtevant, WI 53177*

Most studies of diet in Cooper's Hawks (*Accipiter cooperii*) have concluded that avian prey predominates, but methodological problems may compromise such results. We contrast tallies of prey deliveries to nestlings and prey remains found near nests in Wisconsin. Mammals accounted for a majority of biomass in 2 of 3 nest delivery samples, and reliance on prey remains probably overestimates the proportion of more conspicuous avian items. Prey brought to nestlings was mainly ground-foraging and sub-adult items. We suggest that seasonal, geographic, and

other limitations of existing data preclude generalizations about Cooper's Hawk diets or prey "agility."

EFFECTS OF *TRICHINELLA PSEUDOSPIRALIS* INFECTIONS ON THE PREDATORY BEHAVIOR OF AMERICAN KESTRELS (*FALCO SPARVERIUS*)

BOMBARDIER, M. AND M.E. RAU. *Institute of Parasitology, D.M. BIRD. Macdonald Raptor Research Centre, McGill University, Ste-Anne-de-Bellevue, PQ Canada H9X 1CO. P.Y. JUI. Agriculture Canada, Statistical Research Section, Ottawa, ON Canada K1A 0C6*

T. pseudospiralis did not affect the attack rate or hunting success of kestrels in a modified open-field arena. Infection, however, altered the manner in which insect prey were taken. Thus, the frequency of flight-hunting declined with infection, and birds tended to hunt on foot. In flight, the frequency of wing beats and the horizontal distance travelled to regain the elevated perch increased, making aerial approaches less steep and individual wing beats less powerful. Concordance was found between intensity of infection, magnitude of change in flight activities and body weight. Fenbendazole was 99% effective in killing muscle larvae and treated birds showed signs of rehabilitation.

ARTIFICIAL NEST STRUCTURES FOR FERRUGINOUS HAWKS IN WYOMING

CALL, M.W. AND J.R. TIGNER. *Afton, WY 83110 and BLM, Rawlins, WY 82301*

Between the fall of 1987 and the fall of 1990, 65 artificial nest structures were erected for Ferruginous Hawks nesting in the Rawlins BLM District: 31 by the BLM, 30 by Energy International, Inc., and 4 by the U.S. Air Force. Twenty-six structures were available for nesting in 1988, 54 in 1989, 61 in 1990 and 65 in 1991. One hundred nineteen nests were used during the four nesting seasons of the 206 structures available during those years. Of the 119 active nests, 105 successfully fledged 280 young hawks, for an average over the four years of 2.7 young fledged per successful nest. Use of artificial nest structures is compared between the Rawlins BLM District and the structures erected and studied by Stalmaster (1988) in northern Utah and Colorado and those of Schmutz (1984) in Alberta, Canada.

BALD EAGLE SHORELINE PERCHING HABITAT ON THE NORTHERN CHESAPEAKE BAY, MARYLAND

CHANDLER, S.K., D.A. BUEHLER AND J.D. FRASER. *Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. J.K.D. SEEGAR. Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD 21010*

We studied Bald Eagle (*Haliaeetus leucocephalus*) diurnal perching habitat on the northern Chesapeake Bay shoreline from July 1990 to May 1991. We investigated the

differences between known eagle perch trees and randomly selected trees. We found that perch trees were larger than random trees in both DBH (54.31 cm and 34.80 cm respectively, $P < 0.0001$) and height ($\bar{x} = 19.94$ m and 12.15 m respectively, $P < 0.0001$). Forested shoreline areas had significantly more potential perch trees than either developed or marsh shoreline ($\bar{x} = 42.63$, 26.48 and 8.9 trees, respectively, and $P < 0.0001$ and $P < 0.0001$ respectively). Eagles selected marsh habitat less than expected when compared to unused areas ($\chi^2 = 15.33$, $df = 4$, $P = 0.004$).

PLASMA ENZYME LEVELS OF REHABILITATED RED-TAILED HAWKS FOLLOWING EXERCISE

CHAPLIN, S.B. AND S.T. KNUTH. *Department of Biology, University of St. Thomas, St. Paul, MN 55105*

Plasma levels of lactate dehydrogenase (LD) and creatine phosphokinase (CK) were assayed in four Red-tailed Hawks during their flight conditioning program as a means of assaying muscle damage and providing a measure of muscle fitness. Blood samples (0.5 ml) were taken before flight and at 4, 8, 12, 24, 48 and 72 hours after a standardized exercise of 1500 feet of flight. Unfit hawks sampled at the beginning of their flight conditioning program exhibited significantly higher levels of both LD and CK than well-conditioned individuals. There was a peak of CK activity about 24 hours after exercise in unfit hawks; however, LD levels increased gradually over 48 hours. The usefulness of enzyme assays as measures of flight fitness will be discussed.

POPULATION RECOVERY OF COLORADO PEREGRINES

CRAIG, G.R. AND J.H. ENDERSON. *Colorado Division of Wildlife, 317 W. Prospect, Ft. Collins, CO 80526, and Dept of Biology, Colorado College, Colorado Springs, CO 80903*

Since 1973, all documented peregrine nesting sites in Colorado have been monitored annually and potential breeding areas were surveyed as time permitted. The population increased from a low of 8 occupied breeding territories in 1975 to 58 occupied sites in 1991. Since 1976, 47 previously unknown breeding sites were documented. Population models suggest that the rapid expansion resulted from infusion of 406 young successfully released through fostering and hacking between 1976 and 1989. Productivity of wild pairs improved from 0.44 young per occupied territory during the period of population decline to 1.47 during the recovery phase. Given the rate of reoccupancy, productivity and reduced eggshell thinning, it appears that the Colorado population is secure.

DYNAMICS OF A YEAR-ROUND COMMUNAL ROOST OF BALD EAGLES

CURNUTT, J.L. *South Florida Research Center, Everglades National Park, Box 279, Homestead, FL 33030*

I observed a year-round communal roost of Bald Eagles in southern Florida from April 1990 to February 1991.

Over 77% of eagles observed were subadults. The proportion of adult eagles changed from 5% during the breeding season to 26% during the non-breeding season. Numbers of eagles peaked in July and in December. The number of eagles arriving at the roost was negatively correlated with wind speed and positively correlated with mean temperature. Arrival time correlated with sunset and was not affected by cloud cover. Adults tended to leave the roost later than subadults but the difference was not significant. There were 14 observed displacements and 20 pursuits; all pursuits were between subadults. Unlike most Bald Eagle communal roosts, the Everglades National Park roost is not located near available prey, nor does it offer any obvious advantage in climate. The roost may serve as a social integration mechanism.

LIFE HISTORY OF THE WHITE HAWK IN GUATEMALA

DRAHEIM, G. *Raptor Research Center, Boise State University, Boise, ID 83725*

Initial observations were made on White Hawks during the 1991 breeding season in Tikal, Guatemala. Three nests were located. The mean dbh of the nest trees was 67.3 cm and nest height averaged 23.1 m above the ground. Mean width of nests was 54.4 × 90.8 cm with a vertical dimension of 31 cm. Two eggs were weighed and measured, mean dimension was 44.3 × 53.4 mm and average weight was 55.7 g. Fifty-four prey items were observed; 48% were reptiles, 33% unidentified, 9% mammals, 7% birds and 1% amphibians. Three breeding adult hawks were trapped and measurements were taken. Home range for one breeding adult male was 208 ha.

DEMOGRAPHY OF ARIZONA BALD EAGLES

DRISCOLL, D. AND G. HUNT. *BioSystems Analysis Inc., 303 Potrero 29-203, Santa Cruz, CA 95060*

The number of known Bald Eagle breeding areas in Arizona has grown from 2 in 1970 to 28 by 1990; however, much of this gain may be a result of increased nest search efforts, rather than population expansion. Productivity does not differ significantly from that of other Bald Eagle populations in North America. However, there appears to be a high rate of mortality in some areas. Sixty-one percent of known replacements of missing mates were by eagles in near-adult, rather than full-adult plumage, a rate greatly exceeding those reported for other populations. Whether the high frequency of near-adults as members of pairs results from an expanding population or one experiencing high overall mortality rates is unknown. This study was funded by the U.S. Bureau of Reclamation.

INTESTINAL CECA: WHY OWLS BUT NOT HAWKS?

DUKE, G.E. AND S.B. CHAPLIN. *Department of Veterinary Biology, University of Minnesota, St. Paul, MN 55108, and Biology Department, University of St. Thomas, St. Paul, MN 55105*

All strigiforms have large, well developed ceca yet no falconiforms have them. The major functions of the ceca or cecal flora are believed to be: fiber breakdown, water conservation, metabolism of urinary nitrogen and bacterial competition with gut pathogens. Raptors don't eat fiber and they have little need for additional protein via urinary recycling. Hawks and owls may both benefit, however, from water conservation and being better able to cope with pathogens. We found that cecectomized owls held at 15°C were able to maintain fluid balance eating only freshly killed lab mice with no drinking water. When held at 27°C, however, the cecectomized owls could not have survived without drinking water. Owls and hawks have similar diets and habitats, so if owls need ceca, why don't hawks need them too?

BREEDING DISPERSAL OF GREAT GRAY OWLS IN MANITOBA AND MINNESOTA

DUNCAN, J.R. *Zoology Department, University of Manitoba, Winnipeg, MB Canada R3T 2N2*

The influence of prey abundance and snow cover on the breeding dispersal of radio-marked Great Gray Owls (*Strix nebulosa*) was investigated from 1984 to 1990. Of 1545 prey items identified, 90% were meadow voles (*Microtus pennsylvanicus*). During increase and peak vole population phases, adult owls remained on their breeding home ranges and did not disperse. Breeding dispersal of owls was independent of snow cover and occurred following prey population crashes. On average, adult female owls dispersed farther (466 vs. 214 km, $P < 0.001$) and earlier (October vs. January, $P < 0.05$) than adult males. There was no difference between male and female mean dispersal azimuths (11° vs. 6°, $P < 0.05$) and these were significantly nonrandom ($P < 0.001$). Adult Great Gray Owls exhibited a breeding dispersal pattern best described as a female biased multi-annual migration, rather than nomadism, driven by prey population fluctuations.

DDE, EGGSHELLS AND PRODUCTIVITY IN A RECOVERING PEREGRINE POPULATION

ENDERSON, J.H. AND G.R. CRAIG. *Department of Biology, Colorado College, Colorado Springs, CO 80903, and Colorado Division of Wildlife, 317 W. Prospect, Fort Collins, CO 80526*

DDE in Peregrine egg contents collected 1973-90 declined to less than 10 ppm in 1990. Eggshell thickness increased 1977-82 from a low of 0.290 mm (19% thinner than pre-1947 mean of 0.359 mm) to 0.325 mm but no further improvement has occurred. Large within-clutch variation in thickness of eggshells and fragments greatly lowered their predictive value. Although thickness was inversely related to DDE in the egg contents, the correlation was poor. No trend in DDE or shell thickness was found in individual females over years. Territories in woodland/

brushland were associated with high nesting success compared to montane and subalpine sites, but young fledged per pair, eggshell thickness or DDE did not vary significantly with elevation. Thickness of shells or fragments did not relate to fledging success in a given nesting attempt. The practice of gathering egg or shell samples to determine the status of a population may be dubious.

DO DISPARATE SEX RATIOS IN NORTHERN HARRIERS INFLUENCE THE OCCURRENCE OF POLYGyny?

ENGLAND, M.E. *National Audubon Society, Scully Science Center, 550 South Bay Avenue, Islip, NY 11751*

During a five year study of Northern Harrier breeding biology on a Long Island, New York, barrier beach, I found that female harriers significantly outnumbered males in nestling, fledgling and adult breeding populations. At the mid-nestling stage, 44% of harrier nests contained only female young, and female fledglings outnumbered males by 3:1. Among breeding harriers there were almost twice as many females as males. Reasons for this disparity were not determined in my study, which stressed fitness consequences for the individual arising from the inequality. The excess of harrier females may influence female breeding options, and indeed polygyny rates in the barrier beach nesting areas exceeded 50% over the course of the study years. I suggest that limited male numbers contributed to the occurrence of polygyny in the study population, and that multiple pairings may have enabled more females to breed when the "choice" was between polygyny and not breeding.

ARE OSPREYS SENSITIVE MONITORS OF CONTAMINANT LEVELS AND BIO-EFFECTS ON THE GREAT LAKES?

EWINS, P.J. AND M.E. BARKER. *Canadian Wildlife Service, Canada Centre for Inland Waters, P.O. Box 5050, Burlington, ON Canada L7R 4A6*

In 1991 we initiated a study of Ospreys in two areas of Lake Huron (Georgian Bay and the St. Mary's River) and in a reference area 100 km to the east (the Kawartha Lakes). In these respective study areas 80%, 38% and 59% of active nests occurred on man-made structures. Overall breeding success was 46% in Georgian Bay, 58% in the St. Mary's River and 53% in the Kawartha Lakes, with means of 1.1, 1.8 and 1.3 young fledged per active nest. Aerial coverage of a larger sample of nests provided comparable figures of 1.1, 1.4 and 1.1 respectively. Egg predation by raccoons was important in two areas. In the absence of reliable population counts, or data on age of recruitment or mortality rates, it is difficult to evaluate these productivity figures in relation to the "health" of these populations, even though they are within the range of published values for most stable populations elsewhere in North America. Levels of mercury, 18 organochlorines (OCs) and 41 PCB congeners were determined for 14

fresh and 12 unhatched eggs. These were compared with residues of OCs, total PCBs and mercury in 21 chick blood samples, and with mercury levels in mantle feathers of 23 chicks and feathers molted by 11 adults. These data were also compared amongst study areas and related to reproductive statistics, as well as to previous contaminant levels for Ospreys in Ontario and elsewhere in North America.

BALD EAGLE ACTIVITY ALONG THE UPPER MISSISSIPPI RIVER

GALLI, J.M. *Minnesota Department of Natural Resources, Nongame Wildlife Program, Box 7, 500 Lafayette Road, St. Paul, MN 55155*

This presentation reviews recent efforts to monitor, manage and protect Minnesota's recovering Bald Eagle population. The Bald Eagle is a year-round resident in Minnesota. There are currently 437 occupied breeding areas in the state, with an estimated wintering population of 100-200 eagles occurring primarily along the major river corridor. Results of a four year effort to 1) document eagle winter activity and identify and protect roost sites along the Mississippi River north of Iowa, and 2) monitor and manage a formerly disjunct breeding subpopulation in southeast Minnesota are discussed.

BLOOD PARAMETERS IN WILD GOLDEN EAGLES

GIBSON, M.J. AND D.C. GIBSON. *N2160 W. Rollwood Road, Antigo, WI 54409*. P.T. REDIG. *The Raptor Center, 1920 Fitch Ave., St. Paul, MN 55108*. P.H. BLOOM. *Western Foundation for Vertebrate Zoology, 13611 Hewes Ave., Santa Ana, CA 92705*

Standard hematological and a panel of 21 serum chemical parameters were obtained from 150 Golden Eagles (*Aquila chrysaetos*) trapped in Kern County, California, between September 1985 and January 1987. Body weights, all hematological parameters and several serum chemical parameters associated with nutritional status (e.g., albumin, total protein) showed seasonal variation with low points occurring during summer months. No differences in these parameters were seen as a function of age or sex. Seasonal variation of serum enzymes was also seen. These annual variations affect interpretation of blood data for clinical and toxicological studies.

MORPHOLOGICAL DIFFERENCES OF FERRUGINOUS HAWKS IN ALBERTA AND IDAHO

GOSSETT, D.N. AND M.J. BECHARD. *Raptor Research Center, Department of Biology, Boise State University, Boise, ID 83725*

Preliminary results are described from the first year of a study of morphological differences between subpopulations of Ferruginous Hawks. Measurements of feeding apparatuses were of particular interest due to ecological differences in prey selection in these study areas.

BLOOD CONTAMINANTS OF MIGRANT GOLDEN AND BALD EAGLES IN MONTANA WITH NOTES ON CAPTURE, SIZE AND GENDER ASSIGNMENT

HARMATA, A. *Department of Biology, Montana State University, Bozeman, MT 59717*

Between 1984 and 1990, 85 Golden Eagles and 67 Bald Eagles were captured as migrants, weighed, measured and blood analyzed for heavy metals, hematozoa, pesticide residues and cholinesterase (ChE) levels. Mean Pb levels tended to increase with age, were at or above those considered toxic in both species and tended to be higher in female Golden Eagles. Poor plumage and foot lesions were related to higher blood Pb levels and incidence of Leucocytozoon in Golden Eagles. Mean Se levels tended to decrease with age in Golden Eagles but remained constant in Bald Eagles. Hg was detected only at low levels in Golden Eagles and As overall. DDE was detected in most Bald Eagles and some Golden Eagles. ChE levels were higher in Golden Eagles than Bald Eagles and indicated recent organophosphate or carbamate poisoning in some eagles. Mensural data suggest selection for larger female and smaller male Golden Eagles but larger Bald Eagles. Gender differences in plumage of adult Golden Eagles were noted.

AN OSPREY STUDY AT LOON LAKE, SASKATCHEWAN

HOUSTON, C.S. *863 University Drive, Saskatoon, SK Canada S7N 0J8*. F. SCOTT. *RR #3, Saskatoon, SK Canada S7K 3S6*

Since 1975 we have banded 277 nestling Ospreys in 139 successful nests near Loon Lake. Alpha-numeric color-bands have been used since 1988 on the other leg of all nestlings and on 23 adults, including 5 males. Only one of the trapped adults had been banded as a nestling at Loon Lake 14 years earlier; the rest immigrated from elsewhere. There have been eight retrappings of six adults in subsequent years. Nests in dead trees have been moved to man-made platforms, which now account for more than half the nests. Twelve recoveries to date include two from Columbia and one each from Panama, Costa Rica, Veracruz, Louisiana and New Mexico.

FORAGING STUDIES OF NESTING BALD EAGLES IN ARIZONA

HUNT, G., E. BIANCHI, D. DRISCOLL AND R. JACKMAN. *BioSystems Analysis Inc., 303 Potrero 29-203, Santa Cruz, CA 95060*

In a study funded by the U.S. Bureau of Reclamation, we tracked the daily movements of radio-tagged adult Bald Eagles at seven breeding areas while simultaneously observing prey deliveries to the nest. In riverine habitats, eagles mainly took live fish, while on reservoirs they found carrion. Ecology and life history events of fish, particularly spawning, influenced their availability to eagles on both rivers and reservoirs. Comparing habitat availability with use, we found that eagles foraging in riverine habitats

selected riffles over runs and pools. At breeding areas containing reservoirs, eagles tended to use them as much or more than river sections, and to prefer the areas where free-flowing rivers entered the reservoirs.

PESTICIDE LEVELS AND EGGSHELL THICKNESS IN FOUR SYMPATRIC NEOTROPICAL RAPTORS IN SOUTHEASTERN MEXICO

IÑIGO-ELIAS, E.E. *Department of Wildlife and Range Sciences, 118 Newins-Ziegler Hall, University of Florida, Gainesville, FL 32611-0304*. L.A. ALBERT. *Consultores Ambientales Asociados S.C., Ap. Postal 474, Xalapa, Veracruz 91000, Mexico*. A.F. NAVARRETE. *Martires 28 de Agosto #155-2, Xalapa, Veracruz 91020, Mexico*. L.F. KIFF. *Western Foundation of Vertebrate Zoology, Suite #1400-1100 Glendon Avenue, Los Angeles, CA 90024*

We studied the types and levels of organochlorine pesticides and eggshell thickness in eggshells of four sympatric neotropical raptors (*Elanus caeruleus*, *Buteogallus anthracinus*, *Buteo magnirostris*, *Herpetotheres cachinnans*) in four states in Mexico. Eggs were collected from 1952 through 1969. Between 5-9 organochlorine residues were found in all samples. Eggshells from the four species showed a reduction from pre-DDT era thicknesses.

EFFECTS OF FOREST FRAGMENTATION ON A TROPICAL FOREST RAPTOR COMMUNITY IN THE SELVA LACANDONA REGION OF CHIAPAS, MEXICO

IÑIGO-ELIAS, E.E. AND M.W. COLLOPY. *Department of Wildlife and Range Sciences, 118 Newins-Ziegler Hall, University of Florida, Gainesville, FL 32611-0304*

We studied the effects of forest fragmentation on a community of forest raptors in the Montes Azules Biosphere Reserve and Marques de Comillas area in the Selva Lacandona region of Chiapas, Mexico. During September 1989 to August 1990 we conducted 12 monthly surveys using two different sampling methods: walking line transects (N = 24, 282 replicates) and river transects (N = 11, 126 replicates). Two principal objectives were tested: 1) the effectiveness of different survey methods and 2) to document what changes occurred at the community and species levels due to forest fragmentation. Significant changes occurred in the raptor assemblage (species richness and diversity) and at the species level due to forest fragmentation.

FOREST HABITAT DIMENSIONS OF THE FLAMMULATED OWL

JOHNSON, E.D. AND P.J. ZWANK. *U.S. Fish and Wildlife Service, Cooperative Fish and Wildlife Research Unit, New Mexico State University, Las Cruces, NM 88003*

During the first of two field seasons, 132 Flammulated Owl territories were identified in a surveyed aural landscape of 26 700 ha on the Lincoln National Forest, New Mexico. Average density of Flammulated Owls was estimated to be 0.20/40 ha. Groups of territories contained

2 to 9 males; group territory size ranged from 78 to 628 ha. We will further report on distribution and abundance data collected during the second field season and distribution and abundance relationships to measurements of habitat dimensions.

A HIGH SCHOOL HAWK WATCH PROJECT

KAISER, R. *Belvidere High School, Belvidere, NJ 07823*

This TAPESTRY Award winning hawk watch project offers students a real and immediate project rather than a simulation to study and discuss the issues of raptor ecology. As an interdisciplinary expression through math and verbal avenues students are expected to sharpen scientific skills. Students summarizing their conclusions in a scientific paper is an exercise in organizational and critical thinking. Using Bernice McCarthy's 4MAT system to Learning Styles, the hawk watch activities address all four learning styles exhibited by students as well as left-right brain hemisphericity modes of learning. This project can easily be expanded and coordinated with other schools across the country. It is hoped that contacts can be made and ideas shared to accomplish this task. As a result, students involved will discover an exciting and challenging vocational avenue, ornithological research.

THE DIET OF NORTHERN GOSHAWKS AND COOPER'S HAWKS DURING THE NESTING SEASON IN NORTH-CENTRAL NEW MEXICO

KENNEDY, P.L. *Department of Fishery and Wildlife Biology, Colorado State University, Ft. Collins, CO 80523.*
J.A. GESSAMAN. *Biology Department, Utah State University, Logan, Utah 84322.* R. WARREN. *Environmental Sciences Group MS J495, Los Alamos National Lab., Los Alamos, NM 87545.* B.A. GILROY. *U.S. Fish and Wildlife Service, National Fish and Wildlife Forensics Lab., 1490 E. Main St., Ashland, OR 97520*

During 1984–88 we assessed diet of Cooper's Hawks (*Accipiter cooperii*) and Northern Goshawks (*A. gentilis*) nesting in north-central NM by direct observation of 203 prey deliveries, and analyzing 420 prey remains and 214 pellets collected at nests, perches or plucking posts. Ranking of prey eaten by both *Accipiter* species, categorized by taxon, did not differ between three dietary sampling methods. Results support assumption that periodic samples of prey remains at nests characterize species composition of diet of breeding raptors. In interspecific comparison, no differences were found in ranking of prey taxa used by the two *Accipiter* species in NM. These results indicate sympatric nesting populations of Northern Goshawks and Cooper's Hawks do not necessarily feed on different prey species during nesting season.

USING SOFTWARE IN RADIO-TAG PROJECTS: NOT THE FINAL DECISION

KENWARD, R.E. *Institute of Terrestrial Ecology, Wareham BH20 5AS, U.K.*

Radio-tagging projects often produce neither quantitative results nor analyze data rigorously. This is partly a result of poor planning, and can be overcome by using pilot projects to develop efficient field techniques. Ideally, the data collection technique should maximize the number of animals which can be tracked by minimizing the number of fixes needed for each movement record or home range. Assumptions of fix independence can then be avoided by treating each collection of fixes as a single record in robust tests of differences between individuals, areas, seasons and experimental treatments. This approach requires access to suitable software from the start of a project, with final analyses of multi-animal data sets relying heavily on the programs available. The process is illustrated by using RANGES IV to analyze data from radio-tagged goshawks, buzzards and squirrels.

DISTRIBUTION, DENSITY AND STATUS OF THE GOSHAWK IN PENNSYLVANIA

KIMMEL, J.T. AND R.H. YAHNER, *School of Forest Resources, The Pennsylvania State University, University Park, PA 16802*

We studied the Northern Goshawk (*Accipiter gentilis*) in Pennsylvania from 1988–91 to determine the distribution, abundance and status of this raptor in the state. Information from various sources contributed to identifying 91 locations statewide where goshawks were confirmed to nest in the past 15 years (64 in the past 5 years). The primary breeding range of the goshawk in Pennsylvania is the northern half of the state, excluding the extreme northwestern counties. Censuses conducted in the Allegheny National Forest and the Bald Eagle State Forest yielded minimum densities of 1.17 and 0.73 active nests/100 km² of forest in these two areas, respectively. We estimated the statewide population using three relatively independent techniques; point estimates were 144, 201 and 348 nest sites.

A COMPARATIVE EXAM OF GOLDEN EAGLE NEST SITES IN BOULDER COUNTY, COLORADO

KING, D.W., N. LEDERER AND M. FIGGS. *Boulder County Nature Association, Boulder, CO 80302*

Since first discovered in 1907 by Denis Gale and later evaluated by Malcolm Jolley (1943), nine Golden Eagle nest sites have added a surprising number of young eagles to Colorado's eagle population. This paper will compare a site within the city limits of Lyons to the remaining six nest sites of Colorado's Front Range within the confines of Boulder County.

HOME RANGE AND HABITAT USE OF THE MEXICAN SPOTTED OWL IN SOUTHERN NEW MEXICO

KROEL, K.W. AND P.J. ZWANK. *U.S. Fish and Wildlife Service, Cooperative Fish and Wildlife Research Unit, New Mexico State University, Las Cruces, NM 88003*

We determined home range size and habitat use characteristics of the Mexican Spotted Owl (*Strix occidentalis lucida*) on the Lincoln National Forest, NM. Radiotransmitters were placed on 9 owls (4 pairs and 1 female) in October 1990. The owls were tracked until their transmitters failed, they died or project termination in August 1991. Home range estimates (minimum convex polygon method) of individual owls ranged from 237 ha to 1168 ha with an average of 703 ha. Home range sizes for pairs ranged from 790 ha to 1410 ha with an average of 1121 ha.

MANAGING BALD EAGLES AT THE LOCAL LEVEL: A PROTOTYPICAL ORDINANCE

LINCER, J.L. *BioSystems Analysis Inc., 5355 Mira Sorrento Place, Suite 100, San Diego, CA 92121*

Throughout most of the United States, federal and state regulations deal with impacts to Bald Eagles only after they have been documented. To take a more proactive approach, Sarasota County (Florida) is developing a local Bald Eagle Protection Ordinance. Because of the obvious transferability to other local governments throughout the United States, a prototypical ordinance was produced for further distribution. This ordinance provides for duties of the ordinance administrator, designation and regulation of protective zones, management plans, cease and desist orders, transferrable development rights, variances, a Bald Eagle protection fund, eagle habitat acquisition, penalties and enforcement.

PREDATION OF BLACK-LEGGED KITTIWAKE CHICKS BY COMMON RAVENS ON BACCALIEU ISLAND, NEWFOUNDLAND

MACCARONE, A.D. *Biology Department, Friends University, Wichita, KS 67213*

Baccalieu Island, Conception Bay, Newfoundland, supports several hundred thousand pairs of seabirds, including alcids, gannets and Black-legged Kittiwakes. Common Ravens also breed on this tiny island and prey extensively on the breeding seabirds. Ravens patrol singly or in pairs along the cliff face and attempt to flush adult birds in order to steal eggs and chicks. I describe the predatory strategy and success of the ravens and kittiwake anti-predatory behavior.

TROPHIC CHARACTERISTICS AND GUILD STRUCTURE OF VERTEBRATE PREDATORS

MARTI, C.D. *Department of Zoology, Weber State Univ., Ogden, UT 84408*. K. STEENHOF, M.N. KOCHERT AND J.S. MARKS. *U.S. Bureau of Land Management, Boise, ID 83725*

We examined trophic characteristics of 17 coexisting predators (12 raptors) in southwestern Idaho. Mammalian prey was most important in diets of all the predators. Mean prey mass ranged from 2.2 to 711 g and was correlated with predator mass. Ratios of prey mass/predator mass ranged between 0.4% and 22.5%. Diet overlaps between predators ranged from 1–90%. No significant differences were detected in food niche breadth or mean prey mass between diurnal and nocturnal predators. Dietary overlap between predators with the same diel activity was significantly greater than that between asynchronously-active predators. Mean diet overlap was significantly greater between nocturnal predators than between diurnal predators ($P < 0.004$). Four feeding guilds were present. One owl and one hawk were not members of guilds.

COMMUNAL ROOSTS OF VAGRANT RAVENS ARE MOBILE INFORMATION CENTERS

MARZLUFF, J., B. HEINRICH AND C. MARZLUFF. *Greenfalk Consultants, 8210 Gantz, Boise, ID 83709 and Department of Zoology, University of Vermont, Burlington, VT 05405*

Vagrant Common Ravens in western Maine roost communally and accumulate into groups of 40 or more at food bonanzas during the winter. Three observations on free ranging birds confirm that communal roosts are information centers. 1) Ravens arrive at roosts from a variety of directions, but leave as a group in one or two directions the next morning. 2) Birds, naive of a bonanza's location and experimentally implanted into a roost, follow their roost mates to food, but naive birds, not introduced into a roost, rarely located the bonanza. 3) Significantly more ravens arrive at bonanzas the morning after discovery than can be accounted for by independent discovery and/or local enhancement. Conspicuous social soaring displays facilitate information transfer among members of ephemeral roosts.

GOSHAWK NEST SITE ATTRIBUTES IN NORTHERN NEVADA

MCADOO, J.K. AND J.C. BOKICH. *IMC, Mountain City Star Route, Elko, NV 89801*. J.V. YOUNG AND M.J. BECHARD. *Raptor Research Center, Boise State University, Boise, ID 83725*

In April, 1991, a 3-year study of Northern Goshawks in the Independence Mountains of northern Nevada was initiated as a cooperative effort involving Independence Mining Co. Inc., Boise State University, the U.S. Fish and Wildlife Service, and Nevada Department of Wildlife. During 1991, we determined attributes of 14 occupied goshawk nest sites, utilizing field data and a geographic information system. Nest sites were consistently in mature stands of aspen and specifically in relatively larger aspen trees (\bar{x} height = 7.6 m), located 45–90 m from the edge of the stand. Nest trees had the following characteristics: (1) relatively mild terrain (\bar{x} slope = 21%), (2) distance

to water of 49 m, and relatively open understory vegetation. Eventual abandonment of six nests was not correlated with proximity of habitat disturbance.

THE STATUS OF THE MEXICAN SPOTTED OWL

MCDONALD, C.B., J. ANDERSON, J.C. LEWIS, R. MESTA AND A. RATZLAFF. *U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, NM 87103*. T.J. TIBBETTS. *Arizona Game and Fish Department, 2222 South Houston, Phoenix, AZ 85023*. S.O. WILLIAMS, III. *New Mexico Department of Game and Fish, Villagra Building, Santa Fe, NM 87503*

In 1989, the U.S. Fish and Wildlife Service received a petition to list the Mexican Spotted Owl (*Strix occidentalis lucida*) under the Endangered Species Act. The maximum potential habitat within the U.S. appears to be 5.6 million acres with 99% on public lands. The known population in 1990 was 804 and the maximum estimated population 2160, about one-third the population size of the Northern Spotted Owl subspecies. Considering habitat fragmentation and projected habitat trends, the population may not provide assurance of the species' future security.

USING SATELLITE RADIO TELEMETRY TO TRACK LOCAL AND LONG DISTANCE MOVEMENTS OF AN ALASKAN GOLDEN EAGLE

MCINTYRE, C.L. *National Park Service, 2525 Gambell St., Anchorage, AK 99503*. R.E. AMBROSE. *U.S. Fish and Wildlife Service, 1412 Airport Way, Fairbanks, AK 99701*. P. HOWE. *Microwave Telemetry, 6214 Satanwood Dr., Columbia, MD 21044*

An 85 gram satellite radio transmitter was attached to a nestling Golden Eagle using a backpack-style harness in Denali National Park and Preserve on 2 August 1990. The eagle's movements were monitored by satellite in Alaska, during migration and throughout the winter. The eagle left Denali on 23 September 1990 and arrived in northern Idaho on 15 October 1990. Local winter movements in eastern central Idaho and western Montana were monitored via satellite until March 1991, when the transmitter batteries expired.

GENETIC AND DEMOGRAPHIC STATUS OF PEREGRINE FALCONS IN THE UPPER MIDWEST

MOEN, S. AND H.B. TORDOFF. *Bell Museum of Natural History, University of Minnesota, Minneapolis, MN 55455*. P.T. REDIG. *The Raptor Center, University of Minnesota, St. Paul, MN 55108*

Out of 549 Peregrine Falcon eyasses released over the past 10 years, less than 40 have bred and produced 96 fledglings in the upper Midwest. The reintroduced peregrines differ both genetically and demographically from those which occupied the Midwest prior to extirpation in the 1950s. Genetically, the new population is composed of at least

five subspecies which, because of the species' rarity and the nature of the captive breeding programs, show a high level of inbreeding. The three wild-produced peregrines now breeding in the midwest are also inbred; all three share the same mother. Through DNA and pedigree analyses, we assess the levels of inbreeding and outbreeding of the new population. A banding program of wild young has allowed us to monitor the movements and age distribution of the known wild population. The population is partially migratory and includes birds released from as far away as New Brunswick. The new peregrines are roughly 65% urban. Historical eyries along the Mississippi River remain unoccupied.

BREEDING BIOLOGY OF LAUGHING FALCONS IN RAINFOREST AND AGRICULTURAL LANDS OF THE PETEN, GUATEMALA

PARKER, M. *Department of Biology, Boise State University, Boise, ID 83725*

The breeding biology of Laughing Falcons (*Herpetotheres cachinnans*), has been studied for the breeding seasons of 1990 and 1991 within the primary forest of Tikal National Park. Data were collected in 1991 on birds nesting in man-altered, agricultural habitat outside the park and comparisons made between the two groups as to diet, prey delivery rates, home range and habitat use. Nesting success was 56% (N = 16) over the two years and growth curves for this species were established.

A STUDY OF FACTORS AFFECTING FORAGING HABITAT SELECTION OF OSPREYS (*PANDION HALIAETUS*) AT CASCADE RESERVOIR, IDAHO

PHELPS, J.M. AND M.J. BECHARD. *Department of Biology, Raptor Research Center, Boise State University, Boise, ID 83725*

This two year study involved describing and quantifying physical features critical to Osprey foraging habitat. During the 1990 and 1991 field seasons radio telemetry was used to locate home ranges and foraging habitats of seven nesting male Ospreys. Physical features were described and measured in order to ascertain the significance of these characteristics. Preliminary results indicate the most important factors were those affecting prey (fish) availability, such as water parameters.

NEST SITE SELECTION BY BURROWING OWLS IN COLORADO

PLUMPTON, D. AND R.S. LUTZ. *Department of Range and Wildlife Management, Texas Tech University, Lubbock, TX 79409*

Physical attributes of Burrowing Owl nesting sites were studied in north-central Colorado during 1990 and 1991. In 1990, Burrowing Owls selected burrows in areas of greater burrow density ($P = 0.006$, $\bar{x} = 29$ burrows/0.2 ha) than available ($\bar{x} = 21$). The distance to the nearest

above ground perch at selected burrows was significantly greater than control burrows in 1990 ($P = 0.015$, $\bar{x} = 14.2$ and 7.1 m for selected and control burrows respectively). Orientations did not differ between used and available burrows ($\chi^2 = 11.07$, $P > 0.05$, $df = 7$); both were oriented randomly. Burrowing Owls apparently did not select burrows based on the physical attributes we measured.

ULTRASTRUCTURE OF RED-TAILED HAWK (*BUTEO JAMAICENSIS*) SPERMATOZOA

PRUITT, J.A. AND L.N. IRWIN. *Department of Agriculture, Southwest Missouri State University, Springfield, MO 65804*. C. HAGER AND W.C. CRAWFORD, JR. *Raptor Rehabilitation and Propagation Project Inc., Tyson Research Center, Box 193, Eureka, MO 63025*

The ultrastructure of Red-tailed Hawk spermatozoa was characterized by transmission electron microscopy. The structure was similar to that reported for domestic fowl. The cells were vermiform in shape and apically bounded by a conical acrosome. Spermatozoa also possessed a dense spine under the acrosomal cap that was surrounded by a granular matrix. The nuclear chromatin also appeared to be less dense than that seen in other species.

UNCONVENTIONAL RELEASE METHODS FOR PEREGRINE FALCONS

REDIG, P.T., A. WEAVER AND H.B. TORDOFF. *The Raptor Center and Bell Museum of the University of Minnesota, 1920 Fitch Ave., St. Paul, MN 55108*

In this paper, we describe methods used for release of Peregrine Falcons where efficiency, differential rates of maturity of various subspecies of peregrines, or the vagaries associated with weather, logistics, disease and injury necessitated substantial deviation from conventional hacking methods. Described are: 1) sequential, multiple releases at one site, 2) release at advanced age, 3) short duration pre-release residence in the hack box, 4) trapping and translocation of liberated falcons after attack by adult falcons, and 5) repair, recovery and release within the same release season or in a subsequent year by "re-hacking" of falcons that have sustained fractures.

NEST-BOX USE AND REPRODUCTIVE SUCCESS OF AMERICAN KESTRELS IN SOUTHEASTERN PENNSYLVANIA

ROHRBAUGH, R.W. AND R.H. YAHNER. *School of Forest Resources, Pennsylvania State University, University Park, PA 16802*

We monitored the activity of 131 American Kestrel (*Falco sparverius*) nest boxes during 1990 and 1991. Our objectives were to determine kestrel nest box use patterns and reproductive success. The nest boxes were spaced approximately 0.81 km apart throughout the 1000 km² study area. Habitat of the study area was predominantly agricultural interspersed with fencerows, woodlots and gallery type forests. We characterized 35 breeding attempts in

1990 and 55 in 1991. The mean clutch size was 4.39, mean number of nestlings per pair was 2.20, yielding a hatchability rate of 51%. Mean number of fledglings per successful pair was 3.59, however the number of fledglings produced per breeding pair was only 2.28. Predation and desertion each contributed equally to the 48 (53%) failed breeding attempts.

PREY OF PEREGRINE FALCONS IN GREENLAND: TAKE THE YOUNG, THE STUPID, AND THE MANY

ROSENFELD, R., J. PAPP, J. SCHNEIDER AND W. MATTOX. *College of Natural Resources, University of Wisconsin at Stevens Point, Stevens Point, WI 54481*

We recorded 455 prey items delivered to two Peregrine Falcon eyries during 492 hours of observation from blinds on a 2590 km² study area in west Greenland, 1989-90. Lapland Longspurs, the most abundant prey species available near both nests, contributed the most to the nestlings' diet both in terms of frequency of occurrence and biomass. There were local differences in prey use between the two nests. A minimum of 65% of all longspurs delivered as prey were nestlings and/or fledglings. Analyses of prey items (N = 676) found as remains at 159 eyries in the study area are also discussed.

BIAS IN DETECTING AMPHIBIANS AND REPTILES IN THE DIETS OF NORTH AMERICAN FALCONIFORMES

ROSS, D.A. *Wisconsin River Power Company, P.O. Box 8050, Wisconsin Rapids, WI 54495-8050*. R.N. ROSENFELD. *College of Natural Resources, University of Wisconsin, Stevens Point, WI 54481*. J. BIELEFELDT. *Park Planning, Racine County Department of Public Works, 1420 Washington Ave., Sturtevant, WI 53177*

A literature review of seven species of North American raptors revealed that those food habit studies conducted by direct observation detected amphibians and reptiles more efficiently than did those studies using indirect observation. A combination of indirect and direct study is recommended for some species.

GEOGRAPHIC VARIATION IN THE GROWTH OF NESTLING OSPREYS

SCHAADT, C. *Wildlife Technology, Penn State DuBois Campus, DuBois, PA 15801*

Thirty-one nestling Ospreys evaluated for sex-specific growth performance within a sedentary population in Sonora, Mexico were compared with nestlings from a migratory population in Nova Scotia, Canada. Comparisons of geographic variation by sex showed that Ospreys in the Sonoran Desert had significantly higher weight asymptotes, reduced growth rates, longer nesting periods and later emergence of flight feathers than temperate migratory birds. I present a hypothesis that invokes phenotypic responses to external environmental conditions, namely mi-

gratory habits and climate, as possible factors accounting for differences in morphological features observed between the two populations.

AGE-RELATED DIFFERENCES IN REPRODUCTIVE SUCCESS AMONG FERRUGINOUS AND SWAINSON'S HAWKS IN ALBERTA

SCHMUTZ, J.K. *Department of Biology, University of Saskatchewan, Saskatoon, SK Canada S7N 0W0*

Color-banded Ferruginous and Swainson's Hawks varied greatly in the number of young reared to fledging over several years. A highly successful male Ferruginous Hawk contributed to the fledging of 20 young in seven years. An unsuccessful female Swainson's Hawk raised only one young in eight years. Site and mate fidelity was pronounced. There was no evidence that the hawks changed territories or mates in years after reproductive failures. In both species the youngest known breeder was two years old. The oldest known breeder, a male Swainson's Hawk, is at least 17 years old.

ARE INITIAL OBSERVATIONS ADEQUATE TO DESCRIBE THE BEHAVIOR OF RAPTORS?

SCHUECK, L. AND J. MARZLUFF. *Greenfalk Consultants, 8210 Gantz, Boise, ID 83709*

Initial observations of behavior are statistically independent and often are preferred over continuous observations. However, we compared initial and subsequent behavioral observations of raptors in the Snake River Birds of Prey Area and found that initial observations inadequately describe the full range of behavior exhibited by these species. Using only the first activity observed underestimates the occurrence of rare behaviors and overestimates the occurrence of common behaviors. Studies designed to document rare behaviors such as prey pursuit and capture or inter/intra-specific interactions require continuous observations, but statistical analyses must account for the inherent dependency of such observations.

DNA ANALYSIS OF RED-TAILED HAWK POPULATIONS IN CALIFORNIA AND NEVADA

SHOR, W., P.H. BLOOM, R.S. DELONG, P.J. DETRICH, A.C. HULL AND B. WOODBRIDGE. *Golden Gate Raptor Observatory, Building 201, Fort Mason, San Francisco, CA 94123*. A.D. SIMMONS AND J.L. LONGMIRE. *Los Alamos National Laboratory, Los Alamos, NM 87545*

Blood samples were taken from groups of nestling and parent Red-tailed Hawks in widely separated locations in California and Nevada and from apparent migrants at the Golden Gate. DNA fingerprints were generated from each sample and compared. Although bird band recovery data suggest these birds return to their natal areas to nest, no DNA markers were unique to the locations sampled. This is not an unexpected result considering that this Red-tailed Hawk population is probably contiguous and given the

very high level of genetic diversity that has commonly been detected by DNA fingerprint probes. Immatures flying together in December appeared unrelated. Additional findings will be reported.

THE RESPONSES OF SOUTHEASTERN AMERICAN KESTRELS TO INCREASED AVAILABILITY OF NESTING SITES IN TWO HABITATS

SMALLWOOD, J.A. AND M.W. COLLOPY. *Department of Wildlife and Range Sciences, University of Florida, Gainesville, FL 32611*

Florida populations of the Southeastern American Kestrel (*Falco sparverius paulus*), currently listed as threatened, have declined severely in recent decades due to the loss of natural nesting cavities. A principal objective of this ongoing study is to examine the effect that providing large numbers of nest boxes has on the size of local populations, as determined by a standardized roadside census conducted each August in experimental and control areas in north-central Florida. Prior to the 1991 breeding season, 355 nest boxes were erected in two habitats, longleaf pine/turkey oak sandhills and hardwood hammocks, both of which had been altered by logging and grazing. Kestrels laid eggs in 65 (18.3%) nest boxes, suggesting the presence of a substantial "floater" population. The occupancy rate for nest boxes in sandhills was over twice that for those in hammocks. Clutch size was inversely proportional to laying date in both habitats. Nesting success was greater in the sandhills (67% vs. 36%). The number of fledglings per breeding attempt was inversely correlated with laying date in nests in hammocks, but not in sandhills. Preliminary results of the 1991 census suggest that kestrel numbers are increasing in sandhills where nest boxes have been introduced.

INFLUENCE OF SPATIAL AND TEMPORAL DYNAMICS OF PREY POPULATIONS ON PATCH SELECTION BY BROAD-WINGED HAWKS

STEBLEIN, P.F. *Biological Survey, New York State Museum, Albany, NY 12230*

Broad-winged Hawks were radio-tracked to assess if foraging patches were selected based on criteria consistent with central-place models of foraging activity. Factors that were examined included distance from the foraging site to the nest, amount of prey cover, and variation in composition, abundance and biomass of the prey community at potential foraging sites. Seven hawks were tracked on breeding territories. All major habitat types were surveyed seasonally and annually for mammals, amphibians and reptiles. An index of prey availability was developed that incorporates the abundance and biomass of each prey species and the amount of protective cover. Digital vegetation maps were created and weighted for prey availability, which allowed testing of use versus availability of habitat types by foraging hawks. Broad-winged Hawks demon-

strated significant preference for sites high in prey availability (mature to old-growth forests, forest streams and forest roads). A compensatory relationship was also observed between distance and quality of foraging patches; only high quality sites were hunted in regions distant to the nest.

WINTERING BALD EAGLE POPULATION TRENDS IN IDAHO, 1980-1991

STEENHOF, K. AND R.R. SPAHR. *Raptor Research and Technical Assistance Center, Bureau of Land Management, 3948 Development Avenue, Boise, ID 83705*

We used route-regression methods (Geissler and Noon 1981) to analyze 11 years of mid-winter eagle count data from Idaho. The route-regression techniques allowed us to account for unequal survey effort among years and among regions of the state, a common problem in winter eagle surveys. Statewide counts ranged from 433 in 1980 to 839 in 1991. Trends estimated from adjusted data indicated that populations were stable or slightly increasing. Annual counts in areas where eagles are abundant were less variable than in areas where eagles are rare, but counts from both types of areas correlated positively as did counts from different habitat types. We present recommendations for sampling and analysis of wintering populations in Idaho and elsewhere, based on our findings.

STATUS OF RED-SHOULDERED HAWKS IN IOWA AND POSSIBLE EFFECTS OF INCREASING CROW POPULATIONS ON THEIR NESTING SUCCESS

STRAVERS, J. *Iowa Raptor Foundation, P.O. Box 32, Pella, IA 50219*

Between 1983-91, Red-shouldered Hawks nesting within a three county driftless (unglaciated) area of northeastern Iowa maintained high nest site fidelity and suitable reproductive rates (39 attempts, 29 successful, 2.17 fledged per successful nest, 1.62 per nesting attempt). However, only five nesting attempts were documented during this same period in eight counties in southeastern Iowa, where Red-shouldered Hawk nest site fidelity and reproductive success were poor. We found higher numbers of crows in flood-plain forests in southeastern Iowa and we feel increasing crow populations have a negative impact on Red-shouldered Hawk attempts to re-establish traditional nesting sites or pioneer new territories.

THE CURRENT STATUS OF ARCTIC AND AMERICAN PEREGRINE FALCONS IN ALASKA

SWEM, T., R.E. AMBROSE AND P.J. BENTE. *U.S. Fish and Wildlife Service, 1412 Airport Way, Fairbanks, AK 99701*

Both Arctic and American Peregrine Falcons continue to increase in numbers in Alaska. Surveys in four "index areas" have indicated about a 3-fold increase in the number of nesting peregrines since the mid-1970s. More pere-

grines are found in these areas now than were found in the 1950s and 1960s, and populations are still expanding. It is therefore difficult to predict the levels at which populations will stabilize. Productivity in all areas in Alaska remains high, and there is no evidence of pesticide-caused reproductive failure. The pesticide content of eggs is gradually decreasing, and values are currently well below those found associated with nesting failures.

TURNOVER RATES AND DISPERSAL OF NESTING PEREGRINE FALCONS IN THE NORTHEASTERN UNITED STATES

TELFORD, E. *Raptor Research Center, Department of Biology, Boise State University, Boise, ID 83725*

A study to assess turnover rates and dispersal of cliff nesting Peregrine Falcons (*Falco peregrinus*) was conducted during the 1990 and 1991 nesting seasons. Seventeen nests were visited, and vocal recordings were made of at least 19 different falcons. Band information indicated turnover in three of eight individuals identified. An assessment of the use of sonographic analysis in the identification of individual birds is in progress.

USING A GIS TO INTEGRATE RAPTOR DATA INTO AN AIRCRAFT BIRD AVOIDANCE MODEL

THOMPSON, M.M. *Spectrum Sciences and Software Inc., HQ AFCEA/DMP, Tyndall AFB, FL 32403-6001*

Red-tailed Hawks, Turkey Vultures and Black Vultures account for 33% of the U.S. Air Force's damaging bird-strikes. A Geographical Information System is being used to integrate biological and geophysical data to predict the relative risk of an aircraft collision with a bird. Migration count, banding recovery, Breeding Bird Survey, Christmas Bird Count and research data are being analyzed to monitor raptor altitudinal, temporal, migration and population distributions. Satellite tracking of Turkey Vultures is one example of proposed Air Force sponsored research to determine migration and altitude distribution. A review of analyses will be presented.

FORAGING EFFICIENCY IN SMALL AND LARGE BROODS OF POST-FLEDGING AMERICAN KESTRELS

VARLAND, D.E. *U.S. Fish and Wildlife Service, Iowa Cooperative Fish and Wildlife Service Research Unit, Iowa State University, Ames, IA 50011*

Presumably, young kestrels learn foraging skills during the first 4-6 weeks after fledging. Imitative social foraging during this period may provide an adaptive advantage to individuals later in the juvenile period, if there is strong selection for learned efficiency in foraging. To test the hypothesis that imitative social foraging increases foraging efficiency, I compared foraging efficiency in experimentally adjusted broods of two and five American Kestrels (*Falco sparverius*) after fledging. No differences in foraging efficiency were detected during the four weeks that birds were observed. However, sample sizes were reduced be-

cause of high mortality or signal failure among radio-tracked birds.

EFFECTS OF RADIO TRANSMITTERS ON BREEDING PRAIRIE FALCONS

VEKASY M., J. MARZLUFF AND M. MCFADZEN. *Green-falk Consultants, 8210 Gantz, Boise, ID 83709*

We examined the effects of backpack radiotransmitters on 26 Prairie Falcons nesting in Idaho's Snake River Canyon during 1991. One member of each pair was fitted with a 13 g radio and the pair's productivity was compared to 43 control pairs. Instrumented (I) and control (C) pairs did not differ significantly in productivity (% of occupied sites successful: I = 73, C = 79; fledglings/pair: I = 2.7, C = 3.0; weight [g] of male nestlings: I = 600, C = 558; weight of female nestlings: I = 839, C = 830). Within 13 instrumented pairs, birds wearing radios did not deliver prey items at significantly different rates than birds not wearing radios (prey delivery rate [items/h] of males I = 0.27, C = 0.15; prey delivery rate of females: I = 0.15, C = 0.24).

USE OF WEIGHT TO PREDICT AGE FOR SOUTHERN BALD EAGLES

WALBORN, C. AND B. MASTERS. *Department of Statistics, Oklahoma State University, Stillwater, OK 74078*

A growth curve for Southern Bald Eagles was estimated with weighted least squares nonlinear regression based on age and weight data collected on 190 eagles at the Sutton Avian Research Center. Reliable prediction bands cannot be generated for inverse regression to predict age based on weight from a nonlinear model. Therefore, a linear model was fitted to the data associated with eaglets between 12 and 42 days old. Body weight of eaglets in this subspecies within this age range seems to increase about 101.4 grams per day. Prediction intervals associated with 95% confidence were constructed for the range of ages for which a linear model is appropriate.

USE OF MORPHOMETRIC MEASUREMENTS IN DETERMINING THE SEX OF SOUTHERN BALD EAGLES

WALBORN E. AND B. MASTERS. *Department of Statistics, Oklahoma State University, Stillwater, OK 74078*

A gender prediction equation was estimated with logistic regression to predict the sex of a Southern Bald Eagle. The model was based on foot pad length and bill depth. Although many morphometric measurements were recorded by Sutton Avian Research Center on eagles of this subspecies, these two variables were able to produce an estimated model with 97.9% accuracy.

PRELIMINARY INVESTIGATIONS OF THE ALTAI FALCON IN THE SOVIET UNION

WALTON, B.J. *The Peregrine Fund, c/o Santa Cruz Predatory Bird Research Group.* C.M. WHITE. *Brigham Young*

University. S. SHERROD. *Sutton Avian Research Center.* R. PFEFFER. *Institute Soivjetskaja Kazakistan.* K.E. RIDGLE. *Abu Dhabi Falcon Research Hospital.* J. L. LONGMIRE. *Los Alamos National Laboratory, Los Alamos, NM*

The Altai Falcon (*Falco altaicus*) of central Asia is surrounded by mystery and confusion with regard to nesting range, phylogenetic classification, and even with regard to its existence as an independent species from *Falco cherrug* or *Falco rusticolus*. In June 1991, three of the authors visited the Soviet Union and examined museum specimens, held preliminary discussions and exchanged cultural ideas with Soviet scientists, and conducted field investigations in the Tien Chen Mountains of Kazakistan. Results from DNA fingerprinting for blood samples from Sakers, Gyrfalcons, and Altai Falcons are pending. Future plans for further investigations are discussed.

ENVIRONMENTAL CONTAMINANTS IN BALD EAGLE EGGS

WIEMEYER, S.N., C.M. BUNCK AND C.J. STAFFORD
U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, MD 20708

Bald Eagle eggs (1968-84) were analyzed for organochlorine pesticides, PCBs and mercury. DDE declined in WI, ME and the Chesapeake Bay. DDE was most closely related to shell thickness and reproduction at sampled breeding areas. Sixteen ppm DDE (wet weight) was associated with 15% shell thinning. Reproduction was normal when eggs at sampled breeding areas contained <3.6 ppm DDE; success was nearly halved between 3.6 and 6.3 ppm and halved again when concentrations exceeded 6.3 ppm. Other contaminants were associated with poor reproduction and eggshell thinning; however, their impact appeared secondary to that of DDE.

HISTORICAL DISTRIBUTION AND STATUS OF THE MEXICAN SPOTTED OWL IN MEXICO

WILLIAMS, S.O., III. *New Mexico Department of Game and Fish, Santa Fe, NM 87503*

Specimen and sight records of Mexican Spotted Owls (*Strix occidentalis lucida*) obtained in Mexico over the past 120 years provide an initial understanding of the species' general distribution and relative abundance there. Spotted Owls were reported from 23 locations in 9 Mexican states, the sites being generally confined to the high western, southern, and eastern edges of the Mexican Plateau. Of the total 23 locations, 70% are in Sonora and Chihuahua, with large gaps in the known distribution south and east of there. Available evidence suggests the species was never abundant in Mexico and, based on current and projected rates of habitat alteration, it may be in jeopardy there.

THE HISTORY OF THE NAMING OF THE FERRUGINOUS HAWK

WOFFINDEN, N.D. *Division of Natural Sciences, University of Pittsburgh at Johnstown, PA 15904*

The largest, finest and most colorful of the North American hawks of the genus *Buteo* is the Ferruginous Hawk, *Buteo regalis*. Endemic to a limited area of North America and Mexico, and until recently, poorly known even throughout its range, the species was first collected and named by British and German nationals. One specimen, collected by F. Deppe in 1836, was made the type of *Falco ferrugineus* by H. Lichtenstein, but the name was preoccupied. Another was assigned the name *Buteo regalis* by G.R. Gray of the British Museum in 1844. A.J. Grayson, an American painter and naturalist, named the species *B. californica* in 1857. It is unfortunate that this name was preceded by Gray's, as Grayson was the only worker who knew the species from the wild.

HABITAT USE AND MOVEMENT PATTERNS OF SUBADULT BALD EAGLES IN FLORIDA

WOOD, P.B. *Department of Wildlife and Range Sciences, University of Florida, Gainesville, FL 32611*

Very little was known about seasonal movements or habitat requirements of the various age classes in subadult Bald Eagle populations, particularly in an area such as Florida where resources are widely scattered and eagles do not form large winter concentrations. Consequently, I conducted a radio-tracking study of nestling eagles from spring 1987 to spring 1991. Locations of radio-tagged eagles allowed examination of specific habitat requirements and movement patterns. Landscape level habitat use and distance to various features of the landscape was examined with a Geographic Information System based on a LandSat satellite image.

WHAT DO SWAINSON'S HAWKS REALLY EAT?

WOODBIDGE, B. *U.S. Forest Service, Klamath National Forest, 1312 Fairlane Rd., Yreka, CA 96097*

I examined the diet and prey base relationships of Swainson's Hawks during the course of a long-term population study in northern California. Results of pellet analysis, observations at nest sites and feeding experiments with captive birds were compared. Belding's ground squirrels were strongly overrepresented in pellets and remains in nests whereas montane voles and other small prey were underrepresented. Dramatic seasonal variation in availability and body composition of certain prey species resulted in temporal shifts in prey selection by nesting hawks. Belding's ground squirrels may have been important in increasing body condition of hawks prior to egg-laying, but were not selected by hawks that were feeding young.

POSTER PAPERS

THE ARIZONA BALD EAGLE NESTWATCH PROGRAM

BEATTY, G. *Arizona Game and Fish Department, 2221 W. Greenway, Phoenix, AZ 85023*

Arizona supports 28 Bald Eagle (*Haliaeetus leucocephalus*) breeding areas mostly along the Salt and Verde Rivers in central Arizona. Coordinated by the Department and funded by the Southwestern Bald Eagle Management Committee, the Nestwatch Program places 20 nestwatchers at sites where human disturbance may impact breeding success. Nestwatchers collect biological information, enforce seasonal closures surrounding the nests, and educate the public about desert nesting Bald Eagles. Our display describes the Bald Eagle's adaptations to the desert, impacts that threaten the bird's breeding success, and the Nestwatch Program's place in the State's efforts to manage the species.

THE RAPTOR RESEARCH FOUNDATION. INC.—25 YEARS

CLARK, RICHARD J. *Department of Biology, York College of Pennsylvania, York, PA 17403-3426*

The Raptor Research Foundation first met on 2 September 1965 in Madison, Wisconsin with 12 members from three countries attending. The Foundation has grown to 1059 members from 46 countries. The Raptor Research News was first published in January 1967 at a cost of \$0.25 per issue while *The Journal of Raptor Research* in 1991 costs \$5.50 per issue. Comparing this cost with 32 other publications indicates the cost is third from the lowest with the mean for the journals compared being \$13.63. Membership dues of \$18.00 compared with the average of \$72.10 are extremely low. This poster plots the geography of its membership and the location of its annual conferences. The Foundation's historical background is presented as a basis for planning the Foundation's future.

FIELD OBSERVATIONS ON THE STYGIAN OWL *ASIO STYGIUS* IN BELIZE, CENTRAL AMERICA

FRANZ, MARK. *New College, Sarasota, FL 34243*

A pair of adult owls was observed for one month in June of 1989 on a 1700 acre tract adjacent to the Belize Zoo in Belize, Central America. Observations were made concerning roosting, hunting, and nesting. The observation area consisted of savannah and pine flatwood habitat. During the observation period, the pair utilized the savannah for nesting and hunting and the pine flatwoods for roosting. Hunting was active, and consisted of aerial captures of bats, birds, and large insects primarily at dawn and dusk; pellets collected were composed mainly of bat remains. The nest location was found in savannah habitat at ground level. Very little is known about the Stygian Owl, and the information yielded from these observations, including rare film footage of the subject pair, will serve as a prelude to further study.

WHAT FACTORS CONTROL LAKE SUPERIOR BALD EAGLE PRODUCTIVITY?

MEYER, M.W. AND D.E. ANDERSEN. *Bureau of Research, Wisconsin Dept. of Natural Resources, Madison, WI 53716 and Minnesota Coop. Fish and Wildlife Research Unit, Dept. of Fisheries and Wildlife, University of Minnesota, St. Paul, MN 55108*

The number of Bald Eagles nesting on Wisconsin's Lake Superior shoreline increased from two pairs in the 1970s to 17 pairs in 1991. Reproductive success and productivity of these eagles has improved, although reproductive rates are lower than at inland Wisconsin sites. Prey items and eagle tissues collected along the Wisconsin Lake Superior shoreline have higher concentrations of organochlorines (PCBs and pesticides) than at inland nesting sites, indicating that prey contamination may continue to be a cause of reduced productivity. In addition, climatic data, observations of nest behavior, and nestling lipid levels indicate that the environmental/physical factors may also impact the Lake Superior Bald Eagle population.

NOTES ON RARE AND UNCOMMON BIRDS OF PREY IN QUINTANA ROO, MEXICO

RANGEL-SALAZAR, J.L., P.L. ENRIQUEZ AND E. ESCOBEDO. *Departamento de Ecología Terrestre, CIQRO, Ap. Postal 424, 77000 Chetumal, Quintana Roo, Mexico*

Quintana Roo State supports a large number of raptor species; however, not all of these have been described. In this paper we present our observations on the nest and food habits of the Black Hawk-Eagle (*Spizaetus tyrannus*); food habits of the Black-and-white Owl (*Ciccaba nigrolineata*); and the current distribution records of several birds of prey within the state, such as the Ornate Hawk-Eagle (*Spizaetus ornatus*), Collared Forest-Falcon (*Micrastur semitorquatus*) and the Lesser Yellow-headed Vulture (*Cathartes burrovianus*) among others. The state of Quintana Roo has recently been incorporated into the national development program and the threats to raptor habitats are increasing.

FILMS AND VIDEOS

"ON A WING AND A PRAYER"—G.M. SUTTON AVIAN RESEARCH CENTER'S SOUTHERN BALD EAGLE RESTORATION PROGRAM

COLBERT, K.V., S.K. SHERROD, M.A. JENKINS AND A.E. BESKE. *G.M. Sutton Avian Research Center, P.O. Box 2007, Bartlesville, OK 74005*

This 30-minute video was filmed by award winning video photographer Tim Yoder and is narrated by reporter Rick Peterson of Tulsa's CBS affiliate, Channel 6. The photographer accompanied Sutton Research Center personnel during all phases of the 1990/91 Bald Eagle Restoration

Program field season. The video explains the need and rationale behind the restoration program in a popular and dramatic way while showing all the steps from egg removal to the final success of hatched eagles fledging young in the wild.

TUNKURUCHU

DURING, C. AND J.L. RANGEL-SALAZAR. *Departamento de Difusion, CIQRO, Ap. Postal 424, Chetumal, 77000 Quintana Roo, Mexico*

Conservation of Neotropical raptor communities and species is an important issue in Latin America. In this video, we feature research on the Black-and-white Owl (*Ciccaba nigrolineata*), a threatened species which inhabits the state of Quintana Roo, Mexico. The main goals of the video are to teach raptor study techniques and to relate the importance of the owl in the natural ecosystem. Tunkuruchu is the common name for owls used by Mayan people. They believe that owls are symbols of darkness and death.

INTIMATE NESTING BEHAVIOR OF DAMAGED, WILD, GREAT GRAY, BARRED AND SNOWY OWLS

MCKEEVER, K. *The Owl Rehabilitation Research Foundation, R.R. 1, Vineland Station, ON Canada L0R 2E0*

Video coverage, with pan, tilt and zoom, of successful breeding of these species, among eight others, at the Vineland facility. The tape demonstrates that if damaged, wild owls have access to very large areas, in appropriate vegetation, with choice of mate, territory and nest site, new bonds can be formed and brought to natural fruition. Offspring are raised entirely by their wild parents, protected from human view, pursuing live rodents, and are psychologically releasable whence one parent originated.

GOLDEN EAGLES IN JAPAN—BE AS THE WIND FOREVER

YAMAZAKI, TORU AND M. IWASAKI. *The Society for Research of the Golden Eagle in Japan, 482-57, Yuki-hata, Yasi-cho, Yasu-gun, Shiga Prefecture 520-23, Japan*

Japanese people and Golden Eagles have maintained a close relationship for a long time. But until recently, Golden Eagles existed mainly in legends, and there was no documentation of their ecology. The Society for Research of the Golden Eagle brought to light that there are only 118 pairs in Japan which are moreover threatened with extinction. It took ten years to complete this film in the steep mountains. We have filmed three "Fortresses," the Cliff Nest, the Valley Nest and the Nest in the Wind. This film introduces the ecology and the endangered situation of Golden Eagles in Japan. We have produced this film in the hope that it may raise public consciousness so that Golden Eagles may "Be as the Wind Forever."