W·I·N·G·S·P·A·N

VOLUME 7 NO. 2 SEPTEMBER 1998

MESSAGE FROM THE PRESIDENT

Dear Members,

My first seven months in office have been quite busy. Some of our activity involved responding to conservation issues. The first issue involved disturbance of a nesting aggregation of Griffon Vultures by the Israeli Air Force. I sent a letter to the Commander of the Israeli Air Force expressing our concerns and offering assistance. Thanks to Reuven Yosef for alerting us to the issue and to Jim Bednarz, Chair of the Conservation Committee, for drafting the letter. I also sent a letter to the Alaska State BLM commenting on an EIS for proposed oil and gas leasing in the Colville River area, Alaska. The Colville River is a well known raptor nesting area, particularly for Peregrine Falcons. Thanks to Ted Swem for providing necessary background information and to Jim Bednarz for his work on the letter. Copies of my letters are available and soon will be on the RRF Web page. If you have not seen our Web page, I suggest you do so. Thanks to Carl Marti who has done a stellar job with our home page. The page is still in development, and Carl welcomes your input. Other activities included representing RRF at the North American Ornithological Conference which hosted some 1400 attendees. At the conference, which RRF co-sponsored, I attended the OSNA committee meeting where I signed a revised MOU with the OSNA leadership. Also, I and some Board members and officers met with Ellen Paul, new Executive Director of the Ornithological Council, to discuss current and future OC activities. I sincerely believe that RRF's image with the ornithological community has increased greatly since we joined OSNA.

I feel a bit ambivalent about our last election. We had a slate of fine candidates, and I thank everyone for running and Pat Hall for a super job of running the elections. However, I was disappointed with the lack of response for the presidential race. Although I decided to run again, no one ran against me, and no election was held. This troubles me because people like Mike Collopy worked diligently for the bylaw change to pave the way for the President and Vice-President to be elected by the members. Since the first presidential election we have had three election cycles for President but have had only one real election. In 1994 Mike Collopy and David Bird ran, but in 1996 I ran unopposed. The bottom line is people need to get involved. I will be the first to admit that being President is a very demanding job, but it is also rewarding. It provides opportunities to contribute to RRF and shape its future. As I stated in my last *Wingspan* message, if the members do nothing, RRF does nothing.

Our annual meeting is coming up in Ogden, and it looks like Carl Marti and the local organizing committee are developing a super meeting. See you there!

Mike

RAPTOR RESEARCH FOUNDATION

ANNOUNCEMENTS

UPCOMING MEETINGS

1998

September 30 - October 4
RAPTOR RESEARCH FOUNDATION
Ogden, Utah
Contact: Carl Marti, Department of Zoology, Weber State University, Ogden, UT 84408-2505, phone: 801-626-6172, fax: 801-626-7445, e-mail: cmarti@weber.edu, www: http://catsis.weber.edu/rrf.

November 12-15
FOURTH ANNUAL ALASKA BALD EAGLE FESTIVAL
Haines, Alaska
Contact: Alaska Bald Eagle Festival, P.O. Box 1449, Haines, AK 99827-1449, phone: 800-246-6268, fax: 907-766-2271, www: www.seeknet.alaska.edu/~chamber/.

1999

September 21-26
RAPTOR RESEARCH FOUNDATION THIRD INTERNATIONAL CONFERENCE ON RAPTORS
Trebon, Czech Republic
Contact: Petr Voříšek, Working Group on Protection and Research of Birds of Prey and Owls, Czech Society for Ornithology, Hornoměcholupská 34, CZ-102 00 Prague 10, Czech Republic, phone / fax: 420-2-7866700, e-mail: cso.vorisek@bbs.infima.cz.

November 3-7
RAPTOR RESEARCH FOUNDATION
La Paz, Baja California Sur, Mexico
Contact: Ricardo Rodriguez Estrella, Centro de Investigaciones Biologicas del Noroeste, Division de Biologia Terrestre, km 1 Carretera San Juan de la Costa, La Paz 23000 B.C.S. MEXICO, phone: 112-536-33, fax: 112-553-43, e-mail: estrella@cibnor.mx.

2000

April 2-8
INTERNATIONAL CONFERENCE ON RAPTORS AND OWLS, 2000
Eilat, Israel
Contact: Reuven Yosef, Raptors 2000, IBCE, P.O. Box 774, Eilat 88106, Israel, phone: 972-7-6374276, fax: 972-7-6370890, e-mail: ryosef@bgumail.bgu.ac.il or ryosef@aquanet.co.il.

POSITIONS AVAILABLE

RESEARCH ASSISTANTS ON FALCON SURVEYS We may have positions available for falcon survey work in Asia from March-July 1999. Applicants should be 20+ with a background in biological science and able to manage under difficult conditions in a non-English speaking environment. We provide full training in field techniques before you leave. We can provide academic supervision to include your fieldwork as part of a postgraduate degree. Applicants should send a CV and photograph to: **Dr Nick Fox, National Avian Research Center, Penllynin Farm, College Road, Carmarthen, SA33 5EH, Wales, UK.**

WORKING INTERNS We will have some positions for working interns from approximately May-September 1999. The positions entail working alongside our permanent staff helping to rear, hack and train falcons at our facility in West Wales. We have a staff of 7 who handle about 200 falcons. We provide board and lodging and a small salary. Applicants must be 18 or over and non-smokers. Applicants should send a CV and photograph to: **Dr Nick Fox, National Avian Research Center, Penllynin Farm, College Road, Carmarthen, SA33 5EH, Wales, UK.**

PUBLICATIONS AVAILABLE

"BAFARI" is the newsletter of AÇOR, the Assoc. Cient. Conserv. Aves Rapina. The inaugural issue is an eight-page bulletin which includes photos, graphics, and color artwork. Bafari is the Portugese name for *Falco peregrinus brookei*. Published in Portugese, with figure captions also in English, "BAFARI" is available free of charge from: **AÇOR, Apto 105, 2775 Carcavelos, Portugal.**

AUDIO-VISUAL RESOURCES ON RAPTORS A listing of videos, slides, audio tapes, CD-ROMs, and other resources on raptors is now available. Listings include title, a brief description, source, and price of purchase and/or rental (if available). Unless specifically indicated in the description, all materials are suitable for the general public. Professional raptor biologists may also find many of the listings of interest, as they include profiles of raptor research and conservation programs from many regions of the world. The list can be obtained from: **Nancy Read, RRF Education Committee Co-chair, P.O. Box 714, Los Alamos, CA 93440-0714 USA, email: readn@comm2.vafb.af.mil.** If requesting the list via e-mail, the list will be sent in Word 97 format unless a different format is specifically requested.

NEWS OF MEMBERS

Davide Csermely has a (partially) new e-mail address: csermely@biol.unipr.it.

Nick Fox and staff at The Falcon Facility have new e-mail addresses. General enquiries, sales, research matters, and business should be sent to: office@falcons.co.uk. Confidential and private messages for **Nick Fox, Helen Macdonald**, and **Chris Eastham** should be sent to: N.C.Fox@falcons.co.uk, helen@falcons.co.uk, and chrisfalc@falcons.co.uk, respectively.

Mark Stalmaster has a new address: Stalmaster and Associates, 5190 Hendricks Street, Port Townsend, WA 98368, phone/fax: 360-379-1670.

REQUESTS FOR ASSISTANCE

ALBINISTIC RED-TAILED HAWKS Henry Kendall is researching albinism in Red-tailed Hawks. Assistance would be greatly appreciated. Reports that include date, location, type of observation (i.e., mounted specimen, captive bird, or wild sighting), and a complete description would be most helpful. Please contact: **Henry C. Kendall, 1638 Timberlake Manor Parkway, Chesterfield, MO 63017, phone: 314-532-0658, e-mail: hawkhak5@aol.com.**

BINOCULAR DONATIONS REQUESTED For several years, the RRF Education Committee has been providing donated binoculars and spotting scopes to researchers in need in many regions of the world. Presently, there is a shortage of donated equipment. Please think of RRF when you change or upgrade your optics! Equipment should be in good working condition, not in need of repair. To send donations, or to request a donation for your organization, contact: **Nancy Read, RRF Education Committee Co-chair, P.O. Box 714, Los Alamos, CA 93440-0714 USA, email: readn@comm2.vafb.af.mil.**

FOR SALE

RRF ITEMS Several items are available. Logo pins ($8, flying Prairie Falcon on a cream-colored background); decals ($3); T-shirts from the 1995 (Duluth) annual meeting ($8); and coffee mugs from the 1995 annual meeting ($8). To purchase, contact: **Jim Fitzpatrick, 12805 St. Croix Trail, Hastings, MN 55033, phone: 612-437-4359, fax: 612-438-2908, e-mail: jmfitzpatrick@aol.com.** Payment may be via check or credit card; prices include shipping. For T-shirts, be sure to specify size (S, M, L, XL).

1998 ANNUAL MEETING

The Raptor Research Foundation, Inc. will hold its 1998 annual meeting in Ogden, Utah from 30 September through 4 October at the Ogden Egyptian Conference Center. Details about the meeting and the location are available on the World Wide Web (http://catsis.weber.edu/rrf). A half-day symposium on the Mexican Spotted Owl will be included in the meeting, and a two-day symposium on the conservation of Burrowing Owls will precede the RRF meeting. Contact Carl D. Marti for more information on the RRF meeting (801-626-6172, cmarti@weber.edu) and Geoff Holroyd on the Burrowing Owl symposium (403-951-8689, geoffrey.holroyd@ec.gc.ca).

RECENT THESES ON RAPTORS

Berkelman, J. 1997. HABITAT REQUIREMENTS AND FORAGING ECOLOGY OF THE MADAGASCAR FISH-EAGLE. Ph.D. Diss., Virginia Polytech. Inst. and State Univ., Blacksburg. 152pp.

With a population estimate of 99 pairs, the Madagascar Fish-eagle (*Haliaeetus vociferoides*) is one of the rarest birds of prey in the world. I investigated the ecological requirements of the Madagascar Fish-eagle in 1994 and 1995 to help determine management action to prevent its extinction. I investigated fish-eagle foraging ecology in 1996 to determine its prey preference and whether fish abundance and availability affect fish-eagle foraging rates and foraging success.

Madagascar Fish-eagle nest and perch trees were taller, broader, had more unobstructed branches, and had a greater arc of accessibility than unused trees. Perch trees also were deciduous more often and had a narrower growth form than unused trees. Nest sites had more shoreline perch trees than unused sites. Lakes occupied by fish-eagles were deeper and clearer, and had more shoreline perch trees, more fish, a greater total fish weight, and more fish species than unoccupied lakes.

I developed logistic regression models to predict the probability of Madagascar Fish-eagle use based on the measured habitat variables. Nest and perch tree models included tree height. The nest site model included number of shoreline perches. Lake models included number of shoreline perches and either number of fish, total fish weight, or number of fish species. These models can be used to predict fish-eagle habitat use with > 70% accuracy.

Introduced tilapia, *Oreochromis spp.* and *Tilapia spp.*, made up the majority of both the gill net (66.3%) and fish-eagle catch (64.7%) in similar proportion, which suggests that the fish-eagle is an opportunistic predator. Replacement of native fish species by exotics, thus, probably has not been detrimental to the island's fish-eagle population. Male fish-eagle foraging success was positively correlated with number of fish, total fish weight, and number of fish species, which suggests that declines in the fish population could adversely affect the fish-eagle population.

The results of this study indicate that Madagascar Fish-eagles require bodies of water with large shoreline trees and an ample fish population. I recommend greater protection of aquatic habitats, monitoring and management of freshwater fish populations, and education of local people in sustainable tree harvesting practices.

Britten, M. W. 1998. MIGRATION ROUTES AND NON-BREEDING AREAS OF A SUB-ARCTIC AND TEMPERATE LATITUDE BREEDING POPULATION OF PEREGRINE FALCONS. M.S. Thesis, Colorado State Univ., Fort Collins. 115pp.

I used satellite telemetry to study migration and identify non-breeding areas of adult and juvenile female American Peregrine Falcons (*Falco peregrinus anatum*) (hereafter referred to as peregrines). I compared migration and non-breeding areas of a sub-arctic (~65° N latitude) breeding population on the upper Yukon River (YR) in east central Alaska and a temperate (~37° N latitude) breeding population on Lake Powell (LP) on the Colorado Plateau in southern Utah and northern Arizona. Peregrine populations are recovering throughout North America and the US Fish and Wildlife Service is considering removing the species from protection under the Endangered Species Act. Information on the species' migration routes and non-breeding areas will provide information critical to assessing threats to the species away from the breeding areas.

In Chapter I, I evaluate satellite telemetry as a tool for studying peregrine migration. In Chapter II, I describe the two peregrine breeding populations, present results of the migration study, and describe and compare the migration patterns observed.

I compared poor quality locations calculated by Service Argos Inc. (classes 0, A, and B) using new (1994) location algorithms with known location of Rock Doves (*Columba livia*) tagged with satellite transmitters (platform transmitter terminals or PTTs). The accuracy of these new location classes commonly used in wildlife studies is unreported. Argos class 0 locations averaged approximately 6 km from the true location regardless of whether Argos used the true elevation (1,540 m) or an incorrect elevation (780 m) to calculate PTT position. Class A locations averaged 4.1 and 7.5 km from the true location using correct and incorrect elevations, respectively. Class B locations averaged 35 km from the true location regardless of the elevation used.

I used a new "H-pattern" backpack harness made from 2 mm thick neoprene rubber to attach 30 g PTTs to adult and juvenile female peregrines. I tagged 42 peregrines, 27 from the YR and 15 from LP. All successfully tracked peregrines migrated from their breeding area. I documented outward migration for 30 of 42 (71%) tagged female peregrines and located the non-breeding areas for 23 of the birds (55%). I also documented return migration for two adult peregrines and return migration and dispersal to their potential breeding areas for two juvenile peregrines. There was no significant difference between proportion of PTT-tagged adult peregrines that returned to their breeding area (0.654) and estimated annual survival rate for color banded adult Alaska peregrines (0.732).

YR peregrines migrated south through the central US to non-breeding areas in the Caribbean Basin and Central and South America. LP peregrines migrated south to non-breeding areas on the west coast of mainland Mexico and western Nicaragua (one adult peregrine). The non-breeding areas for peregrines from the two study areas were almost spatially exclusive and represented a leap-frog migration pattern. Within the YR population, individual non-breeding areas were in close proximity in one area of southern Mexico (three adults and one juvenile YR peregrine) and within the LP population, individual non-breeding areas were in close proximity in western Mexico (two locations where two adult peregrines spent the non-breeding season in close proximity) indicating possible non-breeding season concentrations of North American peregrines.

Average migration distances for YR adult, YR juvenile, and LP adult peregrines were 8,917 (range=6,303-14,827; sd=3,031; n=13), 7,024 (range=6,001-7,999; sd=829; n=4), and 2,065 (range=765-4,579; sd=1,327; n=6) km, respectively. One LP juvenile traveled 5,161 km on her first outward migration. YR peregrine migration trajectories were significantly longer than LP trajectories. YR adult trajectories were not significantly longer than juvenile trajectories. Average migration duration for YR adult, YR juvenile, and LP adult peregrines was 44 (sd=33, n=13), 51 (sd=22, n=4), and 19 (sd=16, n=6) days, respectively. Average migration speed for YR adult, YR juvenile, LP adult, and LP juvenile peregrines was 274 (sd=146, n=13), 172 (sd=69, n=8), 174 (sd=110, n=7), and 50 (sd=1, n=2) km/day, respectively. There were no statistically significant differences among groups in migration duration or speed.

Outward migration departure dates were significantly more variable for LP peregrines compared to YR peregrines but migration midpoint dates were not different between the two populations. Two YR peregrines extended outward migration at least into late December.

Follow-up work needs to be done to determine whether there are important non-breeding concentration areas for peregrines and associated risks of chemical contamination or habitat alteration. Satellite tracking of male peregrines should be done to determine their non-breeding areas and migration patterns and whether LP peregrines might be partial migrants according to gender. Overall, satellite telemetry proved to be an effective and efficient tool to document long distance migration of a highly mobile and endangered neotropical migratory bird.

Conrads, D. J. 1997. FAT STORING PATTERNS OF MIGRATING SHARP-SHINNED HAWKS. M.A. Thesis, Univ. Northern Iowa, Cedar Falls. 27pp.

Many species of birds store fat as the primary fuel for migration. Although this is well-documented in many avian families, little is known about fat-storing patterns of migrating birds of prey. Pre-migratory fattening has been recorded in falcons and presumed in buteos. However, fat-storing patterns in migrating *Accipiter* hawks has not been documented. This study examined the fat-storing patterns of Sharp-shinned Hawks (*A. striatus*) during a portion of its fall migration.

During Sharp-shinned Hawk migration three possible fat-storing patterns are predicted: 1) fat deposition increases, 2) fat deposition is maintained, or 3) fat deposition decreases. To determine which strategy is utilized, birds were trapped during September 1996 at two locations along their southward migration: Duluth, MN and Glen Haven, WI.

These locations are approximately 460 km apart. Morphometric measurements were taken at each site to determine whether the birds represented similar populations. Pectoral muscle development was scored to determine condition. Subcutaneous subalar fat content was scored to determine fat deposition.

Analysis of the morphometric data indicated the birds represented the same population. Fat and pectoral muscle score analyses suggested that Sharp-shinned Hawks store relatively little fat, while maintaining good muscle condition during early migration. The low fat storage was consistent with the optimal body fat hypothesis which predicted lower fat storage when food resources are predictable and with the increased threat of predation.

Duxbury, J. M. 1998. AN APPLICATION OF STABLE ISOTOPE ECOLOGY TO THE STUDY OF RAPTOR DIETS. M.S. Thesis, Univ. Alberta, Edmonton. 150pp.

One of the most recent developments in stable isotope ecology is its use in avian ecology. The use of stable isotope ratio analysis (SIRA) to determine the type of ecosystem and the relative trophic level in which raptors are feeding is a new domain. While many traditional dietary studies have been conducted on some raptor species, many species lack dietary information due to remoteness of study areas, small sample sizes or rarity of the species. Valuable information on the diets of these species may be discovered using SIRA. Analysis of heavily studied species along with the more unknown species may help develop associations that can provide insights into the more unknown diets.

When ^{15}N is used to study trophic relationships of organisms, the bioaccumulation effects of the isotope are key. Each consumer contains a higher concentration of heavy isotopes because with each increase in trophic level, organisms are eating prey which has bioaccumulated the heavy isotopes from the previous trophic level. The elimination of lighter isotopes by the predator continues to increase the ratio of $^{15}N/^{14}N$ with the end result that the animals at the top of a food web have higher ratio values than the animals lower in a food web.

Stable isotope ratio analysis of large raptor feathers requires a sampling protocol. During the time that large feathers grow, it is possible for metabolic rates or variable diets to cause changes in the isotope values along a single feather. However, this study demonstrated that any differences in stable isotope ratio values between locations within a feather were insignificant.

As an exploration of the possible applications of stable isotope ratio analysis to birds of prey, feathers from 27 species of raptors commonly found in Alberta were analyzed to determine the relative trophic hierarchy of the raptors. The results of the 27 species indicated that the raptor samples originating in the prairie ecoregion of Alberta had relatively higher $\delta^{15}N$ values than samples obtained in the parkland or boreal regions. The artificial enrichment of raptor tissues on the prairies is probably caused by long term fertilizer use in agricultural practices. Until the degree of how all species are affected by the enrichment factor has been determined, it is recommended that raptor isotope values not be compared between ecoregions.

Differences between isotope values of the age classes suggest a possible difference between what adults feed nestlings and what adults prey upon after their nestlings have left the nest.

This study demonstrated that stable isotope ratio analysis can detect interesting aspects of raptor diets. Traditional methods should now be used to examine why the isotope values are indicating that Alberta Broad-winged Hawks and Great Gray Owls are eating at different trophic levels than what the literature suggests. Taking into account the causes of isotope ratio variability, biological aspects of raptor diets can be studied at the individual, species, and ecoregion guild levels using a combination of stable isotope ratio analysis and more traditional methods. A holistic approach using as many methods as possible will result in the most accurate conclusions about raptor diets.

Eagan, M. 1998. HABITAT AND PERCH PREFERENCES EXHIBITED BY RED-TAILED HAWKS (*BUTEO JAMAICENSIS*) AND AMERICAN KESTRELS (*FALCO SPARVERIUS*) IN THE SACRAMENTO VALLEY, CALIFORNIA. M.S. Thesis, California State Univ., Chico. 51pp.

Large scale agricultural activities in the Sacramento Valley of California have drastically changed the habitat and perch types available to raptor populations. The effects of these changes are relatively undocumented, but may have serious consequences for distribution, dispersal, reproductive success and survival of raptor populations. In this study, the habitat and perch preferences of two common raptor species, Red-tailed Hawks (*Buteo jamaicensis*) and American Kestrels (*Falco sparverius*), were examined.

Perched Red-tailed Hawks and American Kestrels were observed from a vehicle during observation periods in 1997 and 1998. Associations between raptors and landscape elements were identified by comparing the observed incidence of each species on a habitat, perch type or habitat/perch combination, with the availability of that element along the study transect. Results where the observed values were significantly greater than expected were interpreted as preference, significantly lower values were interpreted as avoidance.

Red-tailed Hawks preferred riparian and seasonal wetland and avoided row crop habitat. Analysis of perch use showed that this species preferred a utility pole type with simple metal crossarms.

American Kestrels preferred pasture, orchard and alfalfa habitats, and avoided rice. This species preferred perches on utility wires, and on utility poles with a single wooden crossarm. Kestrels avoided perches in vegetation.

This study found that the habitat and perch preferences of Red-tailed Hawks and American Kestrels are non-random. These patterns suggest raptors have specific landscape requirements. Understanding these requirements is prerequisite to effective conservation of raptor populations.

Ellsworth, E. 1997. POSTFLEDGING BEHAVIOR AND DISPERSAL OF JUVENILE WESTERN SCREECH-OWLS: PATTERNS OF MOVEMENT AND THE EFFECTS OF GENDER AND SOCIAL DOMINANCE. M.S. Thesis, Boise State Univ., Boise, Idaho. 135pp.

Chapter 1. Variation in the timing and distance of dispersal movements by juvenile birds may result from differences in competitive ability. On one hand, low-ranking juveniles may initiate dispersal before dominants if dominants aggressively force subordinate siblings from natal areas. Conversely, if vacant territories are limited and early arriving birds are more successful in acquiring territories, selection would probably operate on young to disperse as early as possible. In this case, dominant individuals with priority of access to resources will mature more quickly and disperse before subordinate siblings. Dominance status also could affect the distance traveled by dispersing juveniles. If long distance dispersal is more costly than short distance dispersal, dominant juveniles should take advantage of their status and disperse shorter distances than subordinates. Alternately, if dominants are in better condition than subordinates and there are advantages to long distance dispersal, dominants should disperse farther than subordinates. I examined the effects of social rank on the timing and distance of dispersal movements by juvenile Western Screech-owls, *Otus kennicottii*, (N = 25) from seven broods. Based on observations of aggressive interactions made using video cameras attached to nest boxes, I assembled dominance matrices and assigned dominance ranks to juveniles within each brood. I radio-tracked juveniles throughout the postfledging period to determine the order in which they dispersed and located juveniles after dispersal to determine postfledging distances. Social dominance influenced the timing of dispersal in juvenile western screech-owls, but gender did not. In six of seven broods, the most dominant juvenile dispersed before its siblings. Moreover, in five of seven broods, the least dominant individual was the last individual to disperse. These data are consistent with the notion that dominant juveniles matured sooner than subordinates, and early maturation enabled them to disperse before less developed siblings. In contrast, social status did not affect postfledging dispersal distance. Instead, variation in dispersal distance appeared to be related to gender, with females dispersing farther than males.

Chapter 2. This study examined the timing, duration, distance, and direction of dispersal movements by juvenile Western Screech-owls, *Otus kennicottii*, in southwestern Idaho. In 1994 and 1995 young owls were radio-tracked throughout the postfledging period on the natal area until they dispersed. They were subsequently located for as long as 12 weeks after dispersal. Young owls typically dispersed in mid-July ($\bar{x}$ = 13 July; range: 28 June to 18 August) after spending an average of 60.0 ± 2.4 days in the natal area after fledging. The mean number of days between dispersal of the first and last juveniles in a brood was 8.5 (N = 11). Males dispersed slightly before females, but the difference was not significant. Young from larger broods remained on the natal area longer than those from smaller broods, which suggests that it takes young in large broods longer to reach a particular skill level or body condition suitable for dispersal. Thirty-one of 35 juvenile screech-owls were found after dispersal from natal areas. These juveniles dispersed an average of 10.6 ± 1.8 kilometers from the nest site to overwintering sites. Females (14.7 ± 3.0 km, N = 15) dispersed farther than males (5.5 ± 1.3 km, N = 16), which fits the general pattern among birds. However, only one of the owls in this study was followed until it bred, so these distances are not natal dispersal distances. Finally, dispersal was directed along a northwest-southeast axis that mirrored the orientation of the Snake River and corresponding riparian woodland habitat in the study area.

Chapter 3. The aim of this study was twofold: 1) to describe the roosting behavior of Western Screech-owls, *Otus kennicottii*, during the postfledging period along the Snake River in southwestern Idaho in 1994 and 1995, and 2) to investigate the influence of social status, age, and gender on the roosting behavior of screech-owls. I used radio-telemetry to locate 2,784 diurnal roost sites of 47 juvenile and 15 adult Western Screech-owls from 15 families throughout the postfledging period prior to dispersal. I video-taped interactions among nestling owls in seven broods to examine social interactions and determine social hierarchies within screech-owl families. Over half of all roosts (58.1%) were in willows, *Salix* spp.; screech-owls used an additional seven tree and six shrub species, and infrequently roosted on the ground (1.2%), in cliffs (0.5%), and in dead trees. Screech-owls roosted in vegetation that provided good cover and concealment (tangle roosts) most frequently (57.8%), followed by roosts on open limbs (29.1%), and next to the trunk (12.3%). Unlike in winter, no screech-owls used tree cavities during the postfledging period. The mean roost site was 2.5 ± 0.1 m high in a tree or shrub 5.5 ± 0.1 m tall with a dbh of 13.7 ± 0.2 cm. Based on a random sample of potential roost trees (N = 100 in each natal area), screech-owls used shorter trees with a smaller dbh than available trees. On average, screech-owls roosted 119.1 ± 3.0 m from their nest sites, and 36.0 ± 1.7 m from the previous day's roost. There was a trend for subordinate young to roost farther from the nest, from adults, from siblings, and from the previous day's roost than did dominant young. I observed some differences in roosting behavior between adults and juveniles, particularly one to two weeks after juveniles left the nest box when juveniles had limited flight skills, and during the last few days before young dispersed. Roosting behavior of juvenile males and females was similar. However, adult males and females appeared to assume different roles in protecting and provisioning young. Adult females roosted closer to the young on average than did adult males, and adult females did not make as many long-distance movements outside of core roosting areas.

Goldstein, M. I. 1997. TOXICOLOGICAL ASSESSMENT OF A NEOTROPICAL MIGRANT ON ITS NON-BREEDING GROUNDS: CASE STUDY OF THE SWAINSON'S HAWK IN ARGENTINA. M.S. Thesis, Clemson Univ., Clemson, South Carolina. 126pp.

Swainson's Hawks (*Buteo swainsoni*) are long-distance neotropical migrants that breed in western North America and spend a third of the year in the grasslands, or Pampas, of Argentina. They were observed in the Pampas during the 1995-96 and 1996-97 austral summers. Widespread agrochemical use to control insects had a profound effect on flocks of Swainson's Hawks foraging on insects throughout the Pampas, resulting in the largest raptor mortality ever recorded. Eighteen mortality incidents were recorded from January through March, 1996. Field surveys in northern La Pampa, western Buenos Aires, and southern Cordoba provinces identified 5,093 dead hawks. Samples from six sites were analyzed forensically to establish cause of death. Forensic analyses indicated that the OP insecticide monocrotophos (MCP) was responsible for the deaths at all six sites. Brain ChE was lethally inhibited (> 95%) and MCP residues (31/45 samples, range 0.05 - 1.08 ppm) were found in the contents of the gastrointestinal tract. No other OPs or carbamates were found. Sample analyses from 6 sites, combined with farmer interviews from another 12 incident sites, indicated that MCP was responsible for 16 of 18 mortality incidents. An MCP-free region in northern La Pampa was designated for the 1996-97 austral summer. In this region, three concurrent campaigns, one each by the chemical industry, an ornithological conservation group, and a federal government agency, were initiated to increase awareness and educate local farmers and chemical applicators. During this season, Swainson's Hawks were studied to determine whether agrochemicals, in the absence of monocrotophos, still posed a serious threat to foraging hawks. Interviews with farmers indicated that MCP was not used in the MCP-free zone on the estates where hawks were captured. One MCP container, however, was found used and discarded in an alfalfa field in northern La Pampa. Plasma cholinesterase activities, determined for 146 Swainson's Hawks, 16 Chimango Caracaras, 4 American Kestrels, 3 Aplomado Falcons, and 1 Burrowing Owl showed no variation from normal. Cholinesterase activities from two incapacitated hawks recovered, when sampled over time, indicating prior exposure to an anti-cholinesterase compound. No organophosphate insecticides were found in footwash samples. One feather sample contained dimethoate at 1.84 ppm. No mortality incidents were found in La Pampa. One mortality incident was discovered in an MCP-use zone in northwestern Cordoba province. Although no particular spray event was determined to cause the death of the 24 hawks, MCP was used for grasshopper control in the vicinity. No other mortality events in Cordoba were found. No chemical residues were found on these birds. A combination of well-managed campaigns, a climate more suitable for productive crop growth, and the removal of MCP produced an effective solution to a severe problem, resulting in decreased hawk mortality in La Pampa in 1996-97. The insecticides used were mostly pyrethroids, used to control caterpillars and aphids in mature sunflower fields, where hawks typically do not forage. Although the number of dead hawks was dramatically reduced in 1996-97, it is recommended that campaigns be rigorously maintained in order to remain successful.

Hall, D. 1996. BUZZARD *BUTEO BUTEO* PREDATION ON RELEASED PHEASANTS. M.S. Thesis, Univ. Reading, England. 53pp.

Predation on pheasant poults from release pens by the Common Buzzard *Buteo buteo* in Dorset, southern England was studied in relation to three heights of vegetation cover within the pen, the distances to nearby buzzard nests and the movements of young buzzards after fledging.

Buzzards were the dominant predators of pheasants during their time inside the release pens, although foxes probably caused more deaths over the whole year. Sparrowhawks and Tawny Owls were also important predators.

None of the vegetation factors significantly affected the predation on young pheasants, however, increased percentage of one metre cover tended to decrease the proportion killed while increasing canopy cover seemed to increase predation. Buzzards may be hampered by the relatively thick vegetation within the pens, but use the canopy as perches from which to drop onto pheasants underneath. Broad opinions of predation numbers by gamekeepers may be responsible for not finding key factors. High pheasant density leads to lower predation. This may be due to an increased collective awareness of young pheasants to predators outside the pen.

A minority of buzzards appeared to cause significant predation in release pens. Of the 130 buzzards which were recorded during five years, only three were identified as serious pheasant predators, a further two as frequent visitors to pens which killed poults and 19 additional birds were classed as infrequent visitors. All other buzzards recorded no interaction with pheasants.

It is recommended that records of all predation incidents should be kept which would give evidence for the selective removal of problem birds.

Harness, R. E. 1997. RAPTOR ELECTROCUTIONS CAUSED BY RURAL ELECTRIC DISTRIBUTION POWERLINES. M.S. Thesis, Colorado State Univ., Fort Collins. 110pp.

Distribution powerline raptor electrocutions have been studied extensively since 1971. Numerous methods to modify powerline structures to eliminate the potential for electrocutions have been developed, published, and utilized by the electric industry. Some of the modified overhead distribution line construction lines have been adopted as standards by investor owned utilities and the Rural Utilities Service, dramatically reducing raptor electrocutions. Although utility construction practices have improved greatly since 1971, some raptor electrocutions persist. Many utilities today are employing larger crossarms in their new construction to provide increased phase-to-phase and phase-to-ground separation to reduce potential electrocutions. Although an emphasis on providing increased separation may eliminate some electrocutions, uninsulated jumper wires on pole mounted equipment may pose a greater threat to eagles, hawks and owls.

Raptor mortality records spanning the years 1986 through 1996 were gathered from 58 electric utilities located in the western United States. The records provided data on 1,450 confirmed raptor electrocutions. These records were reviewed to determine the types of utility structures potentially placing raptors at risk.

The most commonly reported species electrocuted were eagles, with Golden Eagles (*Aquila chrysaetos*) reported 2.3 times more frequently than Bald Eagles (*Haliaeetus leucocephalus*). Juvenile eagles were reported more frequently than adult birds. Eagle mortality was detected at an elevated rate during the late winter. Red-tailed Hawks (*Buteo jamaicensis*) and Great Horned Owls (*Bubo virginianus*) were the most commonly reported hawk and owl species. Hawk and owl electrocutions resulting in electric outages were elevated in the late summer.

Six hundred and forty-six raptor deaths were tied to specific utility construction units. These data suggest that although transformers are relatively rare on rural overhead distribution systems, they are associated with most rural electric raptor electrocutions. Three-phase transformer banks were associated with a disproportionate number of detected electrocutions. These units are particularly lethal to raptors because of minimal phase-to-phase and phase-to-ground separation between bare energized jumper wires connecting transformers, protective cutouts and surge arresters. These units may also be dangerous because they often serve irrigation pumps located in remote areas likely to support numerous raptors.

If correlation implies causation, an emphasis on providing insulated jumpers on all electrical equipment and at tap and deadend locations should provide the greatest amount of protection for all raptor species, including eagles. Fortunately, transformer units can be raptor-proofed without making major structural changes. The amount of exposed energized hardware can be dramatically reduced on new transformer installations by using 600 volt insulated jumper wire and installing insulated bushing covers. Existing transformer units can be retrofitted by either replacing bare wire with 600 volt insulated jumpers or by sliding insulating material over bare jumpers. Several utility manufacturers produce insulating material constructed with an open seam, allowing it to be easily slipped over existing bare conductors. Because the insulating material and bushing covers are relatively inexpensive and easy to install, this option is also economically attractive compared to increasing separation between conductors. Increased phase separation should continue to be used in remote areas with eagle populations.

The 1,450 electrocutions represent an unknown proportion of total mortality because utilities are not required to report raptor electrocutions. All utilities should be required to report raptor electrocutions annually on a standardized form. The form should include detailed information on the types of construction units contacted and address the presence or absence of existing raptor-proofing on structures contacted. This knowledge would provide an indication as to which mitigating measures are working or failing. Recording electrocuted raptor wingspans and body lengths would also help determine clearances required to mitigate raptor electrocutions. Wildlife biologists should aid utility personnel with raptor species identification, and necropsies should be performed whenever possible to rule out other causes of mortality. These data should be compiled and published annually. An observational study designed to monitor distribution line raptor electrocutions would also help determine if information contained in the raptor reporting forms is representative of electrocutions detected.

Hatzofe, O. 1996. EMBRYONIC ECOPHYSIOLOGY OF GRIFFON VULTURES, *GYPS FULVUS*, EGGS. M.S. Thesis, Tel-Aviv Univ., Israel. 56pp.

The Griffon Vulture, *Gyps fulvus*, in Israel are endangered and their populations have been declining since the 1940's. As part of efforts to restock the species back into its former distribution in Israel, a captive breeding project was established in the Canadian Center for Ecological Zoology of the Tel Aviv University Zoology Department. Griffon Vultures lay only one egg per year. Incubation duration is 57 days and fledging time is 115 days. At the breeding center, all eggs are artificially incubated in order to ensure proper incubation conditions. 31 Griffon vulture eggs were artificially incubated and different parameters of the eggs and its physical and physiological parameters were measured from 1989 until 1995. Replacement clutches are induced by removing the first eggs and transferring them to incubators. All the fertile eggs that have been removed for artificial incubation after 7 or more days of natural incubation have hatched successfully. Only 50% of the fertile eggs that were removed between their laying day the 7th day after they were laid and naturally incubated have hatched successfully. Between 1989 and 1995, 28 Griffon Vulture chicks hatched and raised successfully by the captive breeding project, 21 of them by means of artificial incubation.

In order to improve the hatchability and to solve incubation failures, this research has tried to determine the optimal incubation conditions for eggs of Griffon Vultures. In a preliminary research, it was found that the water loss of the Griffon Vultures eggs which were laid in captivity is much lower than the mandatory 15% of the total fresh egg mass necessary for normal embryonic development. The hypothesis of the research was that in captivity, Griffon Vultures lay eggs with a lower water vapor conductance due to thick eggshells. However, this study showed that the eggs laid in captivity have a normal shell conductance (as expected from eggs with an average mass of 240 grams and incubation time of 57 days) and that the water loss problems occur due to the high humidity in Tel Aviv, since the eggs can not evaporate water at a sufficiently high rate. Therefore, eggshells were drilled at the blunt pole in order to increase the eggshell conductance, and a total of 81% hatchability of all fertile eggs was resulted.

Since there were problems at the pipping stage during artificial incubation, another hypothesis tested was that parental assistance is imperative for successful hatching of Griffon Vultures. However, this hypothesis was rejected since it was found that the important parameter is an increase of pressure on the already weakened pipped eggshell, and this can be artificially induced, with good results. Embryonic oxygen consumption was measured in order to compare the Griffon Vultures, which are considered as semi-altricials, with other avian species. This is the first time that the metabolic rate of a falconiform embryo has been measured. In general, metabolism of the embryonic Griffon Vultures is similar to most avian embryos. However, it was found that due to their relatively prolonged incubation time, the embryonic oxygen consumption rate is low, although the total oxygen uptake per body mass during incubation is similar to most avian embryos that have been studied.

The prolonged incubation time of the Griffon Vulture egg is related to its long fledging time. However, the physical and physiological parameters of the egg, e.g. eggshell thickness and pores number, eggshell conductance and embryonic metabolic rate, are tuned to match this lengthy duration of incubation.

McClain, W. R. 1997. PARENTAL INVESTMENT BY EASTERN SCREECH-OWLS (*OTUS ASIO*): THE ROLES OF MALES AND FEMALES IN FEEDING NESTLINGS. M.S. Thesis, Eastern Kentucky Univ., Richmond. 47pp.

It is often assumed that male and female parental effort is nearly equal in monogamous species of birds that rear altricial young. However, there are factors which may contribute to unequal parental effort in monogamous species such as reversed sexual dimorphism (RSD). To investigate the possible effects of RSD on unequal parental investment in raptors, a two year study (1992 and 1993) of the parental feeding behavior of Eastern Screech-owls was conducted. The objective of this study was to examine the provisioning behavior of adult Eastern Screech-owls (*Otus asio*) and, specifically, to investigate the roles of male and females in feeding nestlings.

The behavior of adults and nestlings at eight Eastern Screech-owl nests was monitored by videotaping owls in specially-constructed nest boxes. A total of 2880 visits by adult owls was recorded for the eight nests. During most visits (99.8%), adult owls did not enter the cavity but perched at the entrance. Rarely, when large prey was brought (e.g., birds or small mammals), it was brought into the nest to feed one or more young. In this study all such interior feedings were by the adult female.

Adult screech-owls (males and females combined) delivered prey to nests an average of 15.44 ± 0.17 times/hour.

The time between feedings averaged 3.88 $\pm$ 0.13 minutes (N = 2751) for all nests combined. Adults delivered primarily small prey items. Of identified prey (N = 1682), adult Coleopterans were the most frequently delivered prey, followed by larval Lepidopterans, and adult Lepidopterans (primarily moths). Crayfish composed 3.33% of all prey items. Other invertebrates accounted for 2.6% of prey delivered to the nests by adult screech-owls. Vertebrates were preyed upon less frequently by adult screech-owls (1.42% of prey). Adult screech-owls may have delivered more invertebrates and small prey because such prey were more readily available or because smaller items are more easily handled by nestlings. Total feeding rates (male and female combined) varied significantly among nests, and ranged from 10.05 $\pm$ 0.07 visits/hour to 21.41 $\pm$ 0.85 visits/hour over all nests. This variation between and within locations (nests) may be due to differences in prey availability due to, in part, habitat characteristics.

Overall, adult females made more visits than males, with females making 1630 visits (56.87%) and males 1236 (43.13%). The mean feeding rates of males and females did not differ significantly, with males visiting nests 9.02 $\pm$ 0.17 times/hour and females 9.76 $\pm$ 0.15 times/hour. These results suggest that, at least after brooding, female screech-owls either provide more or as much food for nestlings as males. One possible explanation for apparent reduced feeding rates by males is that males sometimes deliver prey to the females who then take it to the nest. If prey transfer were quantified, it may be found that males are either as active or more active than females in feeding nestlings. Further, there appears sufficient evidence to suggest that greater foraging efficiency in males, as it improves reproductive fitness, may have been an important selective factor in the evolution of reversed sexual dimorphism in Eastern Screech-owls. The type and size of prey delivered by males and females differed significantly, with females delivering 42.17% of all small prey and 53.42% of invertebrate prey. Males delivered 67.5% of all vertebrate prey. These results could be an artifact of the roles of adults in feeding nestlings, where males acquire a search image for larger prey as they are the primary providers when such prey are available early in the season.

Feeding rates of adult screech-owls in this study varied significantly with brood size, with broods of three visited at a higher rate than nests with four and five young. This may be the result of lower energy requirements in larger broods of cavity nesting birds due to decreased thermal losses inside cavities. The size of prey delivered by males and females also varied with brood size, with broods of four and five receiving more large prey.

Total feeding rates by adult owls in my study did not vary with nestling age. Similarly, the size of prey delivered by adults did not vary with nestling age. In contrast, increased feeding rates with increasing nestling age have been reported in several other species of raptors. My results (no increase in feeding rates with increasing nestling age) may be an artifact of the timing of data collection. Observations in my study were limited to the first half of the night, when, as suggested by previous researchers, feeding rates may not change. Also, video recording in my study began after the young could thermoregulate (approx. 12 days of age). Observations shortly after hatching may reveal fewer visits per hour and demonstrate an increase in feeding over the entire nestling period.

Pahkala, M. 1997. THE LINE TRANSECT AND THE RADIO-TAGGING METHODS FOR ESTIMATING NUMBERS OF BUZZARDS (*BUTEO BUTEO*) IN SOUTHERN DORSET, ENGLAND. M.S. Thesis, Univ. Oulu, Finland. 37pp.

The aims of this study were 1) to estimate the density of Common Buzzards (*Buteo buteo*) collected by the line transect method and by radio-tagging, 2) to check the sighting accuracy of line transects in an area of radio-tagged buzzards, and 3) to test the precence prediction from a descriptive population model which estimates from radio-tagging data: the hawk density (200-250), and the proportion of breeders (there should 3-4 non-breeders for 50 breeding birds, about 28% of the population is breeding), and to compare these results with ringing data (about 56% is breeding).

This study was conducted in Southern Dorset, England during two periods: an initial survey was conducted 21.10. - 19.12.1995 as a pilot study. The main survey was conducted during 27.1. - 11.3.1996. Ten transects were placed systematically onto the study area of 120 km^2. The same transect was censused 5 times. Each time a buzzard was seen, it was also checked to see if it had a radio-tag. At the same time buzzards were also radio-tracked by a second observer, to estimate the probability of sighting individuals.

According to tracking estimates, I failed to detect 79-80% of the birds during the pilot surveys. This indicated that, without experience bias can be large (detection probability rose from 20-21% to 69-73%). During the main survey I managed to detect about 69-73% of the birds. This indicates that even under presumed ideal conditions, some violation of assumptions occurred. It is known that the line transect method underestimates the real density.

The total density estimated by radio-tagging was 234 buzzards/120 km^2 during the pilot study and 126 buzzards/120 km^2 during the main study. These values showed that the breeding proportion of the total population (about 34% is breeding) is closer to the estimation predicted by the model from radio-tagging (3 non-breeders for each breeder) than the ringing data (equal numbers for breeders and non-breeders).

Precise estimation of density using line transect sampling schemes involves a mix of basic statistical theory and knowledge of the biology of the population under study. If the study is carefully designed, and all assumptions are met, the line transect method gives an unexpensive, accurate, and quick way to collect data about population density. However, the importance of experience cannot be overemphasised.

During the last 30 years, radio-tags have evolved in size and reliability to become an alternative to rings in raptor demography studies. Radio-tagging may provide a useful complement to ringing as an aid during density estimation by mark-resighting. Radio-tagging can also provide more detailed data than ringing on mortality, density, and proportion of breeders. Although, ringing will remain an essential technique in most studies in birds, radio-tags have already been used to estimate parameters for simple population models of large raptors, and their importance will increase as a means of collecting data to predict future changes in bird populations.

Parker, M. 1997. ECOLOGY OF NESTING LAUGHING FALCONS AND BAT FALCONS IN TIKAL NATIONAL PARK, GUATEMALA: FORAGING AND NICHE BREADTH. M.S. Thesis, Boise State Univ., Boise, Idaho. 86pp.

Three years of breeding season data were collected on the reproductive behavior and food habits of Laughing Falcons, *Herpetotheres cachinnans*, in northern Guatemala to describe aspects of foraging and nesting ecology of this little-studied species. Twenty-three nesting attempts were observed at thirteen nest sites. Vocalizations, nests sites and associated hymenoptera were described and growth curves developed from measurements of the young. There was an indication that nesting attempts associated with nidicolous ants increased fledging success, possibly by decreasing ectoparasite (likely *Philornis sp.*) loads. Foraging and habitat information was gathered through telemetry studies and observations of un-telemetered birds. Laughing Falcons foraged in every available habitat, showing a preference for intact forest and arboreal snakes. They utilized a range of forest strata, from <2 m to emergent canopy trees. It was found that Laughing Falcons were monophagous, eating only snakes in the primary forest of Parque Nacional Tikal and polyphagous outside the borders, where slash-and-burn agricultural practices have modified the landscape. Herpetofauna comprised the majority of Laughing Falcon diets from an observed total of 767 prey items. In mosaic, altered landscapes, Laughing Falcons foraged for snakes, lizards, some small mammals, birds and fish. These birds illustrate a remarkably clear example of an optimally-foraging species, acting as snake specialists in intact rainforest and generalists in human-altered, mosaic habitats.

Four pairs of Bat Falcons, *Falco rufigularis*, were observed in the tropical dry rainforests of Tikal National Park in northern Guatemala to describe feeding ecology and behavior of males and females in this highly sexually dimorphic aerial predator. Food deliveries were observed to identify the relative abundance and importance of different prey species in the diet of males and females. Prey items were identified to the species level when possible, and prey biomass estimates were made. Prey remains were collected daily from one nest. Over 1,500 observational hours at the four nests identified 197 prey species and very little difference between sexes in prey size or type. Hunting excursions were observed above the canopy at two nests, and capture attempts were recorded to reveal no significant differences in success rates between males and females. There were, however, significant differences between nests as to prey types, prey biomass and the female's contribution to prey deliveries. Novel foraging behavior was observed as Bat Falcons gleaned insects from tree leaves.

Rains, C. 1998. NICHE OVERLAP AND NEAREST-NEIGHBOR DISTANCES OF NORTHERN SAW-WHET OWLS (*AEGOLIUS ACADICUS*) AND WESTERN SCREECH-OWLS (*OTUS KENNICOTTII*) IN SOUTHWESTERN IDAHO. M.S. Thesis, Boise State Univ., Boise, Idaho. 106pp.

I compared the nesting chronology, body size, food habits, prey size, and nest site characteristics of Northern Saw-whet Owls (*Aegolius acadicus*) and Western Screech-owls (*Otus kennicottii*) nesting in nest-boxes in the Snake River Birds of Prey National Conservation Area (SRBOPNCA) in southwestern Idaho to evaluate the niche overlap and potential interspecific competition between the two owl species. Overlap occurred in the nesting chronology; saw-whet owl median egg laying date was 14 March, median date of egg hatching was 9 April, and the average fledging date was 14 May. The median laying date for screech-owls was 2 April, and median hatching date was 13 April. Body size of the two owl species did not overlap. Overlap was found in the diets of the two owls for prey species, frequency, biomass, and prey size. Dietary overlap was 99% at coarse resolution (class level) and 82% at fine resolution (species level); the lower overlap at species level indicated that the owls ate different mammal species. The prey sizes taken by the two owl species overlapped; saw-whet owls took prey that ranged from 11-55 g; screech-owl prey ranged 0.5-400 g. Nest-site micro-habitat measurements obtained at nest boxes used by saw-whet owls and screech-owls were similar revealing substantial overlap in nesting habitat for this area. I also examined the relationship of nearest-neighbor distances to nesting success and productivity (clutch size and number of bandable-age young) of Western Screech-owls and Northern Saw-whet Owls. The nesting success of screech-owls was positively significantly related to the nearest-neighbor distance of screech-owl nest-sites ($p = 0.013$), but the relationship to saw-whet nest-sites was not significant. Nesting success of saw-whet owls was not related to the nearest-neighbor distances of either owl. Although not significant, there were trends in the relationship of clutch size and number of screech-owl young to the distance to screech-owl and saw-whet owl nest-sites. This indicated that nearest-neighbor distances of screech-owls affected their nesting success, but nesting productivity levels were not determined by the nearest-neighbor distances. Average nearest-neighbor distances for saw-whet owl nest-sites were 4507 m; average distance of screech-owl nest-sites to screech-owl and to saw-whet owl were 3054 m and 13139 m, respectively. Mean clutch size of saw-whet owls was 5.9 eggs, while that of screech-owls was 4.5 eggs. The average number of young per successful pair was 5.3 for saw-whet owls and 4.1 for screech-owls. The average number of young per nesting attempt was 3.6 for saw-whet owls and 3.0 for screech-owls. Because placement of nest-boxes is sometimes used as a management tool, it is important to understand the possible nest-box requirements of these owl species. I examined the nest-box selection of the two owl species and found that there was no significant difference between nest-boxes selected by saw-whet owls, screech-owls, and unoccupied nest-boxes. However, I found some trends in nest-box selection.

Schaffer, W. 1998. NORTHERN GOSHAWK (*ACCIPITER GENTILIS*) HABITAT CHARACTERIZATION IN CENTRAL ALBERTA. M.S. Thesis, Univ. Alberta, Edmonton. 89pp.

Northern Goshawk (*Accipiter gentilis*) nesting habitat selection and prey use were investigated in central Alberta. Nests were typically located in the lower portion of the crown, on a primary branch fork of large *Populus* trees (mean diameter = 30.0 cm, mean height = 21.9 m). Nesting stands had multiple canopy layers, canopy gaps, large standing and fallen dead trees, and multiple ages of trees that characterize mature seral stages of vegetation. Northern Goshawks did not exhibit a preference for nest site aspect ($0.50>P>0.20$). The nest sites and contrast sites were not significantly different ($\alpha=0.00625$) based on eight vegetation variables (average height of overstory, average DBH, total canopy closure, volume of downed woody debris, live basal area, total herb coverage, total shrub coverage, total basal area) and in the proportion of live and dead stems in different diameter classes (Pearson Chi-square = 7.2049, $0.75>P>0.50$). The majority of the Northern Goshawk diet was composed of prey species from the larger size classes, primarily snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), Ruffed Grouse (*Bonasa umbellus*), Mallard (*Anas platyrhynchos*), and Richardson's ground squirrel (*Spermophilus richardsonii*). In west-central Alberta, an interspersion of forests with different age classes would provide areas where prey populations will thrive (younger age classes), adjacent to areas where prey are available to the Northern Goshawks (older age classes). Northern Goshawk habitat management should include efforts to: conserve active nests; conserve older forests for nesting and foraging habitat; educate resource managers and forestry workers; and conduct further research.

Takats, D. L. 1998. BARRED OWL HABITAT USE AND DISTRIBUTION IN THE FOOTHILLS MODEL FOREST. M.S. Thesis, Univ. Alberta, Edmonton. 139pp.

A two-year ecological study (1995 through 1996) was conducted on the Barred Owl (*Strix varia*) in the Foothills Model Forest (FMF) located in west-central Alberta. The Barred Owl was chosen for study because it is considered an indicator of old growth forest. Little information exists on the Barred Owl in Alberta. The purpose of this study was to investigate Barred Owl nesting, roosting, and foraging habitat use. Broadcast surveys were used to determine the presence and relative abundance of nocturnal owls. Data were collected in March, April, and May. Three hundred calls from six species of owls were recorded at 893 stops for a call rate of 0.34 calls per stop. Moon phase significantly affected the rate of owl calls. Owl call rate was significantly lower in the middle of the night (midnight to 3:59) compared to the early night (20:00 to 23:59) and early morning (4:00 to 07:59). During precipitation, low temperatures, and strong wind, fewer owls called spontaneously or responded to the playback calls. Owls responded significantly more during the two minute silent listening period beginning each 15 minute survey period than in subsequent listening periods after playback. Broadcast surveys, telemetry, and casual observations were used to record information on 42 territorial Barred Owls. Barred Owl density was determined to be 0.05 owls/km^2 and 0.04 owls/km^2 in 1995 and 1996 respectively. Six pairs of owls were investigated for nesting. They were found to nest in natural cavities of large diameter (mean=74.0 cm) balsam poplar trees (*Populus balsamifera*). Barred Owls were found to use old mixedwood stands of white spruce (*Picea glauca*), trembling aspen (*Populus tremuloides*), and balsam poplar for nesting, roosting, and foraging. The Barred Owl is a generalist predator over its Foothills Model Forest range, and feeds on a variety of small mammal, bird, amphibian, and insect species. Some individuals were found to specialize on birds, amphibians, or microtines. They will opportunistically feed on certain species of prey when they are abundant. The Barred Owl can serve as a good indicator of old growth forests, particularly those associated with riparian white spruce and balsam poplar. A draft habitat model, based on literature, was modified to include the importance of balsam poplar trees for nesting and the negative effects of openings associated with Great Horned Owl (*Bubo virginianus*) predation and anthropogenic disturbance.

Takenaka, T. 1998. DISTRIBUTION, HABITAT ENVIRONMENTS AND REASONS FOR REDUCTION OF THE ENDANGERED BLAKISTON'S FISH OWL IN HOKKAIDO, JAPAN. Ph.D. Diss., Hokkaido Univ., Sapporo, Japan. 113pp.

Blakiston's Fish Owl (*Ketupa blakistoni*) is a large, nocturnal, fish-eating owl of the riparian forest, whose distribution is confined to a small part of the Far East. It was designated as a Japanese National Monument in 1971, and the Japanese Red Data Book listed it as "Endangered" in 1988 because of its population reduction. In order to conserve owls, protection of both individuals and their habitats is important. However, the habitat environments and habitat conservation plan have never been studied sufficiently. The aims of this study were to investigate the current status, the distribution change, and habitat environments of the Blakiston's Fish Owl in Hokkaido and to find out the cause and process of its reduction. Most research was carried out from 1991-97 in Hokkaido, the northernmost island and extent of the fish owl's distribution in Japan, with a supplemental study in Ussuri, Russia in 1996.

The number of current owl sites stands at 49, and 30 breeding pairs were recognized in 23 towns. The total number of owls was estimated to be about 120 during the research period, from 1991-97. The current distribution clearly shows the fragmentation of their habitats. More than ⅓ of all sites are located in Shiretoko, the northeastern part of Hokkaido, while other districts have a few sites each. At more than 20% of all sites, owls depend on artificial feeding, and 40% of breeding pairs used only man-made nest boxes. Although the population gradually increased around some sites with artificial breeding assistance after 1984, inbreeding was observed at three sites.

Literature research and records of specimens made clear the past distribution of owls all over Hokkaido. It revealed that owls had lived in 58 towns before the 1950s, and the number of formerly inhabited sites was estimated to be at least 500. The range and population of owls reduced especially in the southern and central part of Hokkaido before the 1950s, while in the eastern part, reduction occurred rapidly during the 1970s to the 1980s.

The increase of cultivated area after the beginning of Hokkaido reclamation at the end of 19th Century and the range reduction of owls were synchronized. In eastern Hokkaido, the average forest ratio decreased from 77.9% in the 1950s to 37.2% in the 1990s at the riparian forest sites where owls disappeared. In Shiretoko District, the population of owls reduced much less than in other regions because of a smaller increase in agricultural land due to severe conditions for agriculture.

Distribution study makes clear that owls have a large adaptability to topography: sites are located up to 800 m high, and the river gradient in the habitat ranged between 0 to 15% in the mountainous coastal area, Shiretoko, and 0 to 3.5% at inland, flat areas. Intensive reclamation of the latter is the main determinant of the fish owl's present distribution, which is limited to coastal and piedmont areas.

Systematic measurement of nest trees in 12 habitats revealed that owls mainly used cavities in broad-leaved trees whose DBHs averaged around 96 cm. Only one pair used a cliff ledge for the nest.

In most current forest, the percentage of trees large enough for breeding was limited because of intensive forest cutting. Only in Shiretoko did trees with DBHs exceeding 70 cm occupy more than 10% at several forests. Forests in Konsen and Tokachi showed a poor quality; trees exceeding 70 cm were rare at several sites. Analysis of DBH distribution in each forest suggests that the forest requires an average DBH of at least 30 cm in order to constantly supply nest trees under natural conditions.

Systematic catching of fish in a river in their habitat revealed that the fish fauna were different between the districts: Dolly Varden was dominant from the upper reaches to river mouths in all rivers in Shiretoko, white-spotted char and Masu salmon were dominant in the Konsen District. The fish fauna in Tokachi was poor and was modified by the obstructing of migration by dams. Chum salmon and pink salmon had characterized the fish fauna all over Hokkaido, but their migration was obstructed by catch at most river mouths for artificial incubation, as well as dam construction.

Statistical analysis of fish density at 33 rivers revealed that fluvial fish density was significantly lower at artificial feeding sites (average density = 12.4 / 100 m^2) and past sites (17.2 / 100 m^2) than at natural foraging sites (68.4 / 100 m^2). This analysis also suggested that owls require a fish density greater than 25 / 100 m^2, which corresponds to 1000 g / 100 m^2 in fish biomass.

Because the fish fauna of Hokkaido is characterized by the anadromous salmonid, the fluvial fish decrease is directly caused by dam construction and commercial fishing, which obstructs the migration of fishes. In addition, river improvement and riparian forest cutting indirectly suppress fluvial fish inhabitation.

From these results, we can recognize the current endangered situation of the fish owl and the reasons for its decline. Three main reasons for the population reduction are: (1) reduction of habitable area, (2) habitat fragmentation, and (3) degradation of habitat quality, especially in trunk size proportion, and fish density and biomass. Conservation planning for the Blakiston's Fish Owl must address the habitat requirements illuminated by this study.

Voříšek, P. 1997. REPRODUCTIVE AND FEEDING ECOLOGY OF COMMON BUZZARD (*BUTEO BUTEO*). Ph.D. Diss., Charles Univ., Prague, Czech Republic. (*Editor's note:* This dissertation consists of six papers, three which have been published and three others which had not been published as of 1997. A pamphlet containing abstracts of all six papers is available from the author: Petr Voříšek, Czech Society for Ornithology, Hornoměcholupská 34, CZ-102 00 Prague 10, Czech Republic; phone/fax: 420-2-7866700; e-mail: cso.vorisek@bbs.infima.cz. This suite of abstracts is introduced as follows.)

Common Buzzard (*Buteo buteo*) is one of the most common raptor species in central Europe. Its population dynamics are affected mainly by abundance of its most important prey, common vole *Microtus arvalis*. However, the evidences for this relationship are still relatively scarce in literature and most of them are rather anecdotal. There are also some methodological aspects of published studies on buzzard population dynamics which make comparisons between areas and years difficult.

Due to its high abundance Common Buzzard represents a good model species for studying general aspects of predator-prey relationship. There are still few studies on a selectivity of avian predation on rodent prey and very few studies on the role of parasites in the predator-prey relationship.

Common Buzzard is still considered as a pest species by gamekeepers in the Czech Republic despite large amount of studies which didn't confirm its negative influence on game species. Thus, studies on the importance of Common Buzzard for gamekeeping are still needed in the Czech Republic.

Aims of the thesis

1. Analysis of temporal changes in the breeding density of Common Buzzard, evaluation of possible causes of extremely high breeding density, which was found in the Biosphere Reserve Pálava (Czech Republic).
2. Description of breeding performance in this concentrated population, analysis of the role of food supply.
3. Test of the selectivity of buzzard's predation towards sex or size categories of its rodent prey.
4. Test of the influence of heteroxenous parasite coccidia on risk of vole predation by buzzard, experimental test of manipulation hypothesis.
5. Analysis of the diet composition of Common Buzzard in the Czech Republic and the evaluation of its importance for gamekeeping.

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Wingspan welcomes contributions from RRF members and others interested in raptor biology and management. Articles and announcements should be sent, faxed, or e-mailed to the editor: Leonard Young, 1640 Oriole Lane NW, Olympia, WA 98502-4342 USA (phone/fax: 360-943-7394, e-mail: wingspan@msn.com). The deadline for the next issue is February 7, 1999.

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