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Table 1. Statistical Analysis of the Sequence of American Kestrel and Loggerhead Shrike Sightings along a 1464-km Eastern Texas Survey Route.

Species		Followed by		P ^a
		American Kestrel	Loggerhead Shrike	
American Kestrel	observed	81	70	
Loggerhead Shrike	expected ^b	56.8	94.2	< .005
American Kestrel	observed	68	180	
Loggerhead Shrike	expected	93.9	154.1	< .005

^aChi-square test for goodness of fit.

^bBased on random sequence.

BOOK REVIEWS

Animali in pericolo in Italia. 1976. Franco Pedrotti (ed.). Camerino: Italian World Wildlife Fund. 710 pp., 119 plates, 154 figures.

Little is known of Italian ecological research outside Italy itself. This volume provides an excellent opportunity to discover the high quality and professionalism of field research conducted by Italian researchers on endangered species. The Italian section of the World Wildlife Fund has financed and organized a limited number of research projects in Italy since 1967. This book contains 20 papers, most of which analyze the results of up to 10 years of field research on the small number of Italian bears, wolves, mouflons, vultures, eagles, ungulates, and frogs. Four of the papers deal with the ecology and distribution of rare animals in the Abruzzo National Park.

Eight papers deal with Italian raptors, usually reporting and analyzing the results of field studies. The first concerns the historic and present status and migration of the Egyptian Vulture (*Neophron p. percnopterus*). The author, G. Bologna, has organized a census of it in Italy from 1971 to 1976. This vulture occurs year-round in Sicily with a breeding population of 40–50 vultures. On the Italian mainland it is confined to the southern half as an uncommon summer resident (breeding population of 70–80 vultures). The species is threatened, and the author suggests strict protection and law enforcement, creation of special nature reserves around nesting areas, and the establishment of “vulture restaurants.”

M. Chiavetta discusses the distribution and nest site selection of Italian Peregrine (*Falco peregrinus*) and Lanner Falcons (*F. biarmicus*). He compares the historic, present, and potential breeding density of both species in a study area, the Apennine Mountains, state of Emilia-Romagna (near Bologna). Nice drawings of cliff cross-sections and a distribution map of falcon nest sites, 1971–1974, complement this study. With a combination of personal travel (80,000 km), reports of hunters, and extrapolation techniques, he estimates the total population of the Peregrine in Italy at around 300–400 pairs

(mostly islands and coastal habitats), and of the Lanner to reach 150–200 pairs ($2\frac{1}{3}$ in the four southernmost states) in 1975.

The next paper by B. Massa summarizes what is known of the biology of Bonelli's Eagle (*Hieraetus f. fasciatus*) and should be valuable reading for anybody interested in this widespread Old World eagle. There are fewer than 10 pairs left in Sicily and about 30 pairs in Sardinia. The only personal field data in this report concern human impact. The article contains eight excellent plates from this eagle's nest in southern Spain by P. Van Groenendall and W. Suetens.

The ecology and the breeding success of the Goshawk (*Accipiter gentilis*) in the Karst region of Trieste in northern Italy was studied between 1966 and 1976 by F. Perco. Many broods were lost because of human impact. The fledgling rate was only 26.3 percent (10 fledglings out of 38 hatched eggs). The principal prey species among a relatively small prey sample examined ($n=54$) was the European Jay (*Garrulus glandarius*), which constituted 46.2 percent of all prey. The home range of the breeding population was estimated at 1,400–2,200 hectares in a highly disturbed region with a human population density of about 1,400 persons/km².

A paper by F. Petretti deals with the breeding ecology of a pair of Black Kites (*Milvus migrans*) in the marshes near Rome, probably the first such study from southern Europe. He reports on daily activity cycles (two strong peaks in the morning and in the late afternoon), on the electrocution of a fledged Black Kite, and on the prey spectrum (85% fishes).

The most interesting raptor paper in this book concerns the behavior and ecology of a pair of Golden Eagles (*Aquila chrysaetos*) in the Apennine Mountains of Umbria. Unfortunately, author B. Ragni uses a literary, anecdotal approach that makes reading difficult and time-consuming for this foreign reader. The observed eagle pair raised 77 eaglets over a period of just six years (1971–1976), an exceptionally high breeding success for this species. The main prey consisted of hares (*Lepus europaeus*).

During the winter months the adult male drove off the juvenile eagles from his territory. The male was the sole hunter during the breeding season. The eagle pair separated temporarily in late summer and fall; the adult male remained in the territory while his mate became the most solitary member of the family. The author includes good sketches of eagle behavior, and witnessed a number of remarkable happenings, including the male's attack on a glider.

Finally, there is the excellent article by H. Schenk (a vulture specialist) on the faunistic situation on the large Tyrrhenian island of Sardinia. The status, history, and prognosis for the future is treated for the Cinereous Vulture (*Aegypius mouachus*), the Griffon Vulture (*Gyps fulvus*), the Bearded Vulture (*Gypaetus barbatus*), and several eagles, hawks, harriers, and falcons. All accounts are accompanied by good statistical data and distribution summaries.

Hartmut Walter

Hirald, F., Delibes, M., & Calderon, J. 1979. El Quebrantahuesos *Gypaëtus barbatus* (L.). Sistematica, Taxonomia, Biologia, Distribucion, y Proteccion. Inst. Nac. para la Conserv. de la Naturaleza, monogr. No. 22. 183 pp. (available from Servicio de Publicaciones Agrarias, Paseo de Infanta Isabel, 1. Madrid-7.)

This exciting monograph on the Bearded Vulture (*Gypaëtus barbatus*) is a required reading for all vulture specialists and thought-provoking for other raptor students. Chapter 1 is on the "bonebreaker's" morphology (little sexual dimorphism; males are

slightly smaller). The largest size belongs to specimens from Central Asia, the smallest to the Ethiopian population, a cline following Bergmann's ecogeographical rule. The authors suggest a taxonomical revision reducing the number of subspecies to only two on the basis of a combination of size and plumage characters: *G. b. barbatus* of Eurasia and northern Africa, and *G. b. meridionalis* of eastern and southern Africa. Succeeding chapters deal with territoriality, food requirements, and the entire reproductive cycle. There is a wealth of data on metabolic needs and geographical variation of egg size. After a general status survey (fig. 28 should include Sardinia as a breeding habitat) the question is posed: Why is the Bearded Vulture disappearing? Various direct and indirect human impacts have caused the death of many adult birds, raising the otherwise very low natural mortality rate among adults. Since sexual maturity is reached at the age of 5 or 6 years, and the chances of a fledged bird to reach maturity are rated below 10 percent, the annual recruitment into the breeding population is too low to compensate for the much larger loss of adults.

The last chapter deals with the conservation measures on the Iberian Peninsula to protect the existing breeding areas and populations and to revitalize former breeding locations. First, protection of existing breeding nuclei has to be effective, absolute, and well coordinated among all administrative agencies involved in the effort. Second, recolonization requires human assistance, in this case the transport, care, and release of young Bearded Vultures (probably from the Pyrenean population) into suitable historic breeding habitats.

This monograph has a soft cover, 21 tables, 35 figures, and a large number of typing errors. The latter can be found and corrected with a special error data sheet. The English summary is excellent. It covers chapter by chapter and makes it relatively easy for the non-Spanish reader to extract the important materials from this modern study, a true testimonial of the quality of raptor research in Spain today.

Hartmut Walter

Feeding ecology and niche differentiation in Goshawk (*Accipiter gentilis* L.) and Sparrowhawk (*Accipiter ninus* L.). P. Opdam. Drukkerij Presikhoof, Ruitenbergloan 29, Arnhem, The Netherlands. 91 pp., paper, price not given, obtainable from Rijksinstituut Voor Natuurbeheer, Leersum-Uasteel, Broehhuizen, The Netherlands (in English with Dutch summary).

This volume represents the collected papers of Paul Opdam, brought together in one volume, with J. Thissen, P. Verschuren, and G. Muskens coauthoring some of the Goshawk material. There are seven chapters of which three have been previously published in European journals. (A seventh chapter consists only of a Dutch summary.) Chapter 1 is an introduction to the overall theme of the study, which is to test Cause's principle and to compare the feeding ecology of these two raptors to see if intra- and interspecific differences in body size are correlated with differences in food. Chapter 2 describes the feeding ecology of a population of Goshawks on either side of the Dutch-German frontier over the 1969-1973 period. This paper was previously published in *J. Ornithol.* 118 (1):35-51, 1977. Perhaps the salient finding was that although at least 72 identifiable species showed up as food, the bulk of the remains consisted of only five species. These latter species were related to an environment created by modern man's agricultural practices and the breeding and racing of homing pigeons. Twenty-two species were recorded as prey items only once in the four-year study. The Goshawk population dis-

cussed is one of the most dense in Europe, again correlated with a landscape managed intensively for agriculture.

Chapter 3 (previously published in *Ardea*, 66:137–155, 1978) treats Sparrowhawk feeding ecology in a fashion similar to that of the Goshawk in chapter 2. The proportion of prey from three different categories (field, village, and forest species) are compared for each season. Like the findings on Goshawks, although over 100 prey items were identified, only nine species made up about 70 percent of the food items. Chapter 4 (previously published in *Ardea*, 63:30–54, 1975) then brings together data from both studies to present a comparative picture of sex, species, and temporal differences between them in sympatric areas that tend to lead to both intra- and interspecific partitioning of resources. For example, in winter the family turridae made up less than 10 percent of the Goshawk food but more than 20 percent of the combined Sparrowhawk food; within the Sparrowhawks, males took only 6 percent of their food fare from turridae, but females' diet was more than 58 percent turridae. On the other hand, the family columbidae made up less than 1 percent of the Sparrowhawk food and 70 percent of Goshawk food. Female Goshawk take of Domestic Pigeon (*Columba livia*) was only 21 percent, and that species made up 40 percent of male Goshawk food. Opdam concluded that each accipiter "group" (each sex by species) occupied a somewhat different niche, with intraspecific overlap more extended than interspecific overlap. The niche-breadth decreased under poor (in winter) food conditions.

The new material in the publication comes in chapters 5 and 6 and apparently represents a heretofore unpublished analysis by Opdam. Chapter 5 is titled "Niche utilization in coexisting accipiter species." He raises several questions regarding the number of accipiter species that can coexist and whether the "accipiter niche" space in western Europe is sufficiently occupied that a third species cannot also coexist with the two there. The Levant Sparrowhawk (*A. brevipes*) comes closest geographically to being a third accipiter in western Europe. The main purpose of his discussion is not to solve any problems relating to his question but to indicate fields of research wherein these questions might be answered.

For some of the analysis in chapter 5, prey items are classed into 13 size groups. Unfortunately we are not told what the size groups are other than that size groups 3–4 correspond to the weight of male Sparrowhawks, group 6 to the weight of female Sparrowhawks, and group 10 to the weight of male Goshawks. Some prey sizes are exploited 2–3 times more than others, and those most heavily used correspond to the weight of the accipiter sex that catches it. Opdam suggests that certain sized prey might include many species of high vulnerability and that the frequency of that size class in the food items simply outnumber the low vulnerability species and thus accounts for the correlation. Plotted values on the mean body weight of the two western European and largest and smallest North American accipiter against mean body weight of their respective prey fits a straight line. The middle-sized North American accipiter (Cooper's Hawk *A. cooperi*) deviates from this line suggesting to Opdam that mean prey size is also governed by factors other than size of the predator. Finally Opdam suggests that the reason only two accipiters are sympatric in western Europe while three are in North America is that in North America the distribution of birds weighing up to his size class 8 differs from Europe in such a way that the niche-space of *A. ninus* can be occupied by two species i.e. *A. striatus* and *A. cooperi*. His discussion of coexisting accipiters in other parts of the world is provocative, especially concerning the tropics.

The final chapter is entitled "Sexual Size Dimorphism and Feeding Ecology in Birds of Prey with Special Reference to Goshawk and Sparrowhawk." Three general categories of theories on sexual dimorphism are broached, namely, (1) niche-differentiation hypothesis, (2) ethological-function hypothesis, and (3) hypotheses emphasizing energetic advantages for efficient foraging during reproduction. These hypotheses each incorporate the main questions, Why do the sexes differ in size? Why do the species differ in the amount of dimorphism? Why is the female the largest? Opdam's discussion on the niche-differentiation hypothesis, for accipiters at least, concludes it is unlikely that for Goshawks and Sparrowhawks food will regularly be in short supply during the breeding season whereas during winter limited food may cause competition and reinforce size differences. His analysis supports the conclusion that bird-eating accipiters show the greatest dimorphism, and reptile, amphibian, or insect eaters least. Twelve forms of predominantly bird-eating accipiters had an average sexual dimorphism index of 15.8 percent, 12 forms with mixed prey choices an index of 12.4 percent, and 6 species of predominantly reptile, amphibian, insect, or small mammal eaters an index of 8.5 percent. Opdam then points out problems or exceptions to the three main hypotheses centered around the ethological function proposals for dimorphism and the four main hypotheses that argue for an energetic benefit to sexual dimorphism.

In conclusion, he postulates that for *A. nisus* and *A. gentilis*, and perhaps the entire genus *Accipiter*, the following four processes determine dimorphism: (1) intraspecific competition for food resulting in sexual size differences, (2) interspecific competition for food to help set limits to the amount of dimorphism, (3) different mortality rates resulting from intraspecific niche differences also helping to set limits to the amount of dimorphism, and (4) energetic factors setting limits to the amount of dimorphism. The one glaring error is the spelling *tung* for *tongue*, but this volume is certainly a contribution to the library of any serious student of falconiforms.

C. M. White

ABSTRACTS OF THESES AND DISSERTATIONS

THE ECOLOGY AND STATUS OF THE HARRIS' HAWK (*PARABUTEO UNICINCTUS*) IN ARIZONA

Abstract

The Harris' Hawk was studied in Arizona from January 1976 to October 1977. Its past and present status and distribution are described. Where two separate populations once resided in Arizona, one now remains and occupies 3,880 sq km of the Arizona Upland subdivision of the Sonoran Desert.

Nests were built or old nests repaired from January to August, and eggs were set from mid-January to mid-August. Extra clutches were documented in fifty nesting ranges. Occasionally second clutches were laid before young of first broods were fledged. Fledging dates ranged from April to October. At nine locations active nests were .8 km apart, and at two locations nests were just .5 km apart. Within two study areas nesting density was 2.5 sq km per active nest. The mean distance between nests was 1.8 km. In 1977 Harris' Hawks reoccupied 91 percent of the nesting ranges used in 1976. More than two adults were observed at 46 percent of 227 nesting ranges.

Productivity was ascertained for 396 nesting attempts. The average clutch contained 3.16 eggs (range 1-5) and an average 1.62 young fledged per nesting attempt. Seventy-four percent of the nesting attempts were successful.

Food habits, mortality, and factors influencing frequency of double broods and the