J. Field Ornithol., 63(4):476–487

RECENT LITERATURE

Edited by John A. Smallwood

RESEARCH TECHNIQUES

(see also 17)

1. **A method for age determination of Blue Jays in northeastern United States and southeastern Canada.** R. P. Yunick. 1992. N. Am. Bird Bander 17:10–15.—The objective of this study was to develop plumage-based criteria for distinguishing age classes of Blue Jays (*Cyanocitta cristata*). The author examined 262 museum specimens and 410 banding captures originating from the region described in the title. Both wing chord and tail length differed significantly between age classes (HY/SY versus AHY/ASY) and between sexes, but the large region of overlap precluded these characteristics from being useful for age or sex determination. The white terminal band on the rectrices of males was significantly wider than that of females, but large birds of both sexes had wider bands than smaller birds, and the width did not differ significantly between age classes. The width of the white terminal tips of the secondaries was not related to gender, but differed significantly between age classes. The length of the white tips on secondaries S1 and S2 identified up to 65% of the sample of HY/SY birds with over 95% reliability. The author presents these data very effectively in two tables. Table 1 shows the summary statistics (means, ranges, standard deviations, and sample sizes) of these parameters for the age and sex classes. Table 2 lists the reliability (percentage of birds in the sample of known designated age) and applicability (percentage of the measured sample whose age class was recognized) for the various lengths of the white tips of S1 and S2. [1527 Myron St., Schenectady, NY 123091, USA.]—John A. Smallwood.

2. **An unexpected sex ratio in a sample of Northern Saw-whet Owls.** R. S. Slack. 1992. N. Am. Bird Bander 17:1–5.—In owls, females tend to be larger than males. The currently available key to sex determination of Northern Saw-whet Owls (*Aegolius acadicus*) is based on wing chord (U.S. Fish and Wildlife Service, 1980, Washington, D.C.). However, the overlap in the range of wing chord values for males and females results in a considerable proportion of birds for which sex remains unknown. Further, there has been some controversy concerning the validity of the wind chord criterion and its applicability in the study of population sex ratios (see Mueller, 1990, J. Field Ornithol. 61:339–346).

In the present study, the author captured 150 saw-whets during spring migration along the south shore of Lake Ontario, New York, between 1981 and 1988. Birds were assigned to three categories, male (n = 11), female (n = 46), or unknown (n = 93), based on wing chord. Three possible explanations for the apparently skewed sex ratio are offered: (1) behavioral differences made females more likely to be captured, (2) the measurements were inaccurate, or (3) the sexing criterion was invalid.

The author notes that differences in habitat use by the sexes have not been reported for this species, and that "there would be no reason to assume" differential timing of migration or separate migratory routes, although these potential factors do not receive further consideration in the paper. Also not considered is differential trapping vulnerability. Although the trapping technique is not identified in this paper, a cited paper (Slack et al., 1987, Wilson Bull. 99:480–485) indicates that the owls were mist netted. After discounting behavioral differences, the author provides a compelling argument that measurement error is an unlikely explanation for the apparently skewed sex ratio. Finally, the author supports Mueller's (1990) contention that the wind chord criterion is not valid.

This reviewer would argue that because a substantial portion of the sample fell into the overlap range, very little inference about the actual sex ratio is possible. To simply ignore the unknown birds and calculate a ratio from 11 known males and 46 known females implicitly assumes that the proportion of males that could be identified was identical to the proportion of females that could be identified (i.e., that the sample of unknown birds also had an 11:46 sex ratio). This assumption would be difficult to justify. The amount of uncertainty here is very large, considering the fact that most (62%) of the sample fell into the overlap range, where the sex ratio is unknown. [Box 532, Rd. 1, Phoenix, NY 13135, USA.]—John A. Smallwood.

BEHAVIOR

3. Natal dispersal in relation to nutritional condition in Spanish Imperial Eagles. M. Ferrer. 1992. Ornis Scand. 23:104–107.—The causes of natal dispersal, both proximate and ultimate, have received much attention in the ornithological literature. Toward shedding new light on this topic, Ferrer monitored 21 radio-tagged Spanish Imperial Eagles (*Aquila adalberti*) throughout the predispersal period (i.e., from independence until moving >20 km from the nest). Nutritional condition was assessed by measuring levels of urea and uric acid in blood just before the young fledged.

The predispersal period averaged 9.2 days (range 1–23 days). Regardless of relatedness, adults attacked all independent young that visited nests. Length of the predispersal period was not related to the age or sex of the fledgling, date of independence, length of the dependency period, hatching date, or brood size. Interestingly, blood levels of both urea and uric acid were significantly positively correlated with length of the predispersal period, indicating that young in poor condition tended to remain longer on their natal home ranges. These results suggest that young eagles disperse by choice as soon as their physical condition permits. Such behavior would be adaptive if early dispersers settled in better sites than late dispersers. [Estación Biológica de Doñana, Avd. Maria Luisa, Pabellón del Perú, 41013 Sevilla, Spain.]—Jeff Marks.

4. Cryptic behaviour in moulting hen Willow Ptarmigan *Lagopus l. lagopus* during snow melt. J. B. Steen, K. E. Erikstad, and K. Høidal. 1992. Ornis Scand. 23: 101–104.—Before laying eggs in spring, female ptarmigan replace their white winter plumage with mottled brown summer plumage. At the same time, melting snow results in a mosaic of white and dark areas. During this transition period, do the birds modify their behavior to remain cryptic?

Steen et al. observed five female ptarmigan in central Norway from mid-April to mid-May and found that they typically matched their background while foraging. When only about 5% of their body was covered with pigmented feathers, hens fed in the snow zone 86% of the time, whereas after they were >20% pigmented, they fed only in the snow-free zone. The availability of food was such that to remain camouflaged, the hens had to stop feeding on willows (a protein-rich food) and switch to dwarf birch (a protein-poor food). Thus, the hens apparently had to lower their intake of protein to reduce their conspicuousness to predators. [Div. of General Physiology, Univ. of Oslo, N-0316 Oslo 3, Norway.]—Jeff Marks.

5. Male-biased dispersal in the Great Bustard *Otis tarda*. J. C. Alonso and J. A. Alonso. 1992. Ornis Scand. 23:81–88.—Great Bustards have a lek (typically) or harem (less frequently) mating system and probably the strongest sexual size dimorphism of all birds. The authors studied marked bustards in Spain from 1983 to 1990 to monitor movements throughout the annual cycle and to document natal dispersal. Natal dispersal was strongly and significantly male-biased, averaging about 7 km for males and 3 km for females. Males also dispersed at an earlier age than females and began attending leks at a later age (2.7 versus 1.9 years).

Aside from waterfowl, male-biased dispersal is rare in birds. The authors suggest that young males disperse in search of leks not occupied by older males, whereas females, which invest considerably more energy in the young than do males, presumably benefit by settling in familiar surroundings.

The results of this intriguing study seem to uncover many more questions than answers. Clearly, more dispersal data are needed from bird species with strongly polygynous mating systems. [Museo Nacional de Ciencias Naturales, CSIC, 28006 Madrid, Spain.]—Jeff Marks.

6. Redhead duck behavior on lower Laguna Madre and adjacent ponds of southern Texas. C. A. Mitchell, T. W. Custer, and P. J. Zwank. 1992. Southwest. Nat. 37:65–72.—The behavior of Redheads (*Aythya americana*) was quantified during winter on the hypersaline system Laguna Madre and on nearby freshwater ponds in southern Texas. In saltwater habitats feeding (46%) and sleeping (37%) were the dominant activities. Feeding occurred mostly during the early morning hours (64%) and feeding rates were significantly higher on colder days ($P < 0.0001$). Redheads fed by dipping significantly more often (58%) than either by tipping (25%) or diving (16%, $P < 0.0001$), and no significant differences were detected in the frequency of behaviors and feeding rates between the sexes. Feeding by dipping may have been advantageous since dipping sequences consumed less time (5.3 s) compared with tipping (8.1 s) or diving (19.2 s), and thus were perhaps energetically less costly. On freshwater ponds sleeping (75%) was the dominant activity and such ponds served as a source of fresh water for Redheads acclimating to the hypersaline water of Laguna Madre. Because Redheads fed almost entirely on shoalgrass (*Halodule wrightii*), the documented decline in monotypic shoalgrass meadows in lower Laguna Madre could have adverse effects on the numbers of wintering Redheads in the region. [School of Forestry, Wildlife, and Fisheries, Louisiana State Univ., Baton Rouge, LA 70803, USA.]—Danny J. Ingold.

FOOD AND FEEDING

(see also 4, 6)

7. Search tactics of a pause-travel predator: adaptive adjustments of perching times and move distances by Hawk Owls (*Surnia ulula*). G. A. Sonerud. 1992. Behav. Ecol. Sociobiol. 30:207–217.—After having erected artificial poles at different heights in a 20-ha clearcut in southeast Norway, the author examined the effect of perching height on the allocation of search and pursuit effort in Northern Hawk-Owls over a 10-year period. On average, hawk-owls had to visit 4.9 perches for each capture attempt and 13.5 perches for each prey capture. Horizontal attack distance increased with increasing perching height, suggesting that increasing height offers hawk-owls an increased radius for their search area. Giving-up time increased with perching height in over 50% of the individual cases, and move distance after leaving a perch, having not detected prey, also increased when owls left higher perches. However, move distance depended just as much on subsequent perch heights as it did on preceeding ones, and was only weakly correlated with giving-up time. When only one perching height was considered, owls seemed to move slightly farther than optimal. These findings suggest that hawk-owls are able to identify the feasibility of individual perches before landing on them and allocate their search time accordingly. Moreover, when leaving their perch, individuals appear to adjust their move distance to both the experienced size of the preceding search area and the expected size of the next one. [Dept. of Biology, Div. of Zoology, Univ. of Oslo, P.O. Box 1050, Blindern, N-0316 Oslo 3, Norway.]—Danny J. Ingold.

8. Diet and nesting success of Barn Owls breeding in western Nebraska. J. A. Gubanyi, R. M. Case, and G. Wingfield. 1992. Am. Midl. Nat. 127:224–232.—The authors examined the diet of Common Barn-Owls (*Tyto alba*) in Lincoln County during the 1984–1986 breeding seasons. From pellets and debris collected at 26 nest sites, 10,140 prey items were identified. Rodents comprised 95.3% of the diet with prairie voles (*Microtus ochrogaster,* 32.7%) being the dominant individual prey species. *Microtus* spp., and hispid pocket mice (*Perognathus hispidus*) occurred significantly more frequently in the diet ($P = 0.0001$) than expected from trapping, while deer mice (*Peromyscus maniculatus*) occurred significantly less frequently. Moreover, the percent of prairie voles increased in the diet from 17.6 to 43.5% during the 3-year period while the mean number of owls fledged per nesting attempt increased significantly from 1985 to 1986 ($P = 0.02$). The annual precent of prairie voles in the diet was significantly negatively correlated with two smaller species, western harvest mice (*Reithrodontomys megalotis*) and deer mice. The results suggest that an increased population density of prairie voles resulted in an increased prey base for barn-owls, and therefore an increased reproductive effort in 1986. Thus, although it appears that Common Barn-Owls have prey preferences, they seem to adjust their diet according to the availability of prey species during any given year. [Nebraska Game and Parks Comm., Rt. 4, Box 36, North Platte, NE 69101, USA.]—Danny J. Ingold.

NESTING AND REPRODUCTION

(see also 3, 8, 11, 12, 19)

9. **Breeding and age in female Black Grouse *Tetrao tetrix*.** T. Willebrand. 1992. Ornis Scand. 23:29-32.—From 1984 to 1987, the author radio-tagged 53 adult and 25 yearling female Black Grouse in central Sweden. Yearlings had lower reproductive success than older females, hatching 48% versus 71% of their clutches, losing 82% versus 35% of their broods, and raising 0.16 versus 1.72 chicks per year. One explanation for these differences was that yearling females were in poorer condition during spring. Yearlings weighed less than older females and laid smaller eggs and clutches. Also, grouse numbers were declining in the study area as the forest matured. Yearlings may have been less efficient than older females in obtaining food in low quality habitats. [Dept. of Zoophysiology, Uppsala Univ., S-751 22 Uppsala, Sweden.]—Jeff Marks.

10. **Sex ratios in broods of the Lesser Kestrel *Falco naumanni*.** J. J. Negro and F. Hiraldo. 1992. Ibis 134:190-191.—Natural selection should favor the parental strategy of producing offspring of the gender most likely to maximize the parent's genetic representation in future generations. Factors affecting this likelihood include the parental investment required for producing and rearing each gender of offspring, and the existing sex ratio of the population of potential mates for those offspring. Most falconiform birds are monogamous, and the sex ratio of fledglings recruited into the pool of potential breeders tends to be close to unity. In a study of Eurasian Kestrels (*Falco tinnunculus*), Dijkstra et al. (1990, Funct. Ecol. 4:143-147) observed that although the sex ratio of all fledglings produced during the breeding season was nearly 1:1, early broods tended to be male-biased while later broods tended to be female-biased. In this species, typical of most falcons, males engage extensively in courtship feeding and provide most of the food for their incubating and brooding mates. Dijkstra et al. interpreted the seasonal shift in brood sex bias as an adaptation which allows yearling males the maximum amount of foraging experience prior to the rigors of their first breeding attempt; a couple of extra months experience would be of lesser benefit to females, whose preparation for breeding is more a matter of maturation than of learning.

In the present study, the authors observed Lesser Kestrels breeding in eight colonies in southern Spain during three years, 1988-1990. Nestling gender was determind at 2-4 weeks of age. The overall nestling sex ratio did not differ significantly from unity: 246 males and 243 females were observed. In a more convincing analysis (broodmates are not statistically independent, making the previous result difficult to interpret), the authors compared the observed frequencies of broods of various sex composition with those expected from binomial expansion. Again, there was no evidence of skewed sex ratios. For a third analysis, each breeding season was divided into three periods corresponding to the dates during which 33%, 67%, and 100% of the clutches had been laid. No significant shifts in fledgling sex ratios were detected. The authors conclude that the mechanism of parental manipulation of offspring sex ratios present in the closely related Eurasian Kestrel was not operating in Lesser Kestrels. [Estación Biológica de Doñana, CSIC, Apt. 1056, E-41080 Sevilla, Spain.]—John A. Smallwood.

HABITAT USE AND TERRITORIALITY

11. **Habitat use of the Northern Harrier in a coastal Massachusetts shrubland with notes on population trends in southeastern New England.** D. A. Christiansen, Jr. and S. E. Reinert. 1990. J. Raptor Res. 24:84-90.—Habitat use by Northern Harriers (*Circus cyaneus*) was studied at Barney's Joy Point, South Dartmouth, Massachusetts, from February 1987 to April 1988. Year-round harrier activity is described, including dates of breeding territory establishment and initiation of courtship, nest building, and roosting behaviors. Roosting harriers in the study area usually numbered 15, and ranged from two to 23. Most harriers left roost sites 10 minutes before sunrise and returned 10 minutes past sunset. Mean shrub heights in Roosts 1 and 2 were 68.7 and 83.7 cm, respectively. Most individual roost sites were smaller than 0.23 m^2, and harriers were often faithful to these sites.

Breeding territories were located in shrub-dominated habitats, and the mean height of shrubs in Territories 1 and 2 were 84.8 and 82.2 cm, respectively. Other than Cape Cod, Barney's Joy Point represents the only known mainland breeding site for harriers in Massachusetts; breeding populations have been extirpated from mainland Connecticut and Rhode

Island. The use of upland shrub habitats as harrier breeding sites is discussed, as well as harrier population trends in southeastern New England. [Lloyd Center for Environmental Studies, P.O. Box 7037, South Dartmouth, MA 02748, USA.]—Robin J. Densmore.

12. Climatic and oceanographic influences on island use in four burrow-nesting alcids. G. W. Kaiser and L. S. Forbes. 1992. Ornis Scand. 23:1-6.—More than 2,000,000 pairs of alcids breed along the west coast of North America between 48° and 55°N latitude. Four species make up >98% of the breeding individuals: Ancient Murrelet (*Synthliboramphus antiquus*), Cassin's Auklet (*Ptychoramphus aleuticus*), Rhinoceros Auklet (*Cerorhinca monocerata*), and Tufted Puffin (*Fratercula cirrhata*). These species breed on <2% of the region's 6500 coastal islands, and most of the breeding colonies have been occupied since at least the turn of the century. Prolonged occupancy of so few sites suggests that specific local features are especially favorable for seabird breeding.

To determine if Pacific alcid colonies are located randomly, the authors examined the distribution of colonies relative to long-term climatic and oceanographic properties. Soil and vegetative cover were suitable for alcid nesting on most islands, and predators occurred on all islands. Alcid colonies were located on islands in cold water with high salinity, and rainfall tended to be less intense on occupied islands than on noncolony islands. Cold, saline waters had higher food availability, and drier islands reduced the risk of nest flooding and burrow collapse. Proximity to high quality feeding areas and security of the burrow site are potential proximate cues in the selection of nesting islands by alcids. [Canadian Wildlife Service, Box 340, Delta, BC V4K 3Y3, Canada.]—Jeff Marks.

13. Habitat selection by breeding Black-throated Blue Warblers at two spatial scales. B. B. Steele. 1992. Ornis Scand. 23:33-42.—Black-throated Blue Warblers (*Dendroica caerulescens*) feed and nest in the forest understory, and their distribution appears to be influenced by shrub density. Working at the Hubbard Brook Experimental Forest in New Hampshire, Steele determined how the distribution and density of warblers are affected by shrub density at (1) the plot scale, and (2) the territory scale. At the plot scale, warblers were censused and shrub densities measured on seven plots averaging 15 ha, and shrub foliage was reduced experimentally on one 14-ha plot. At the territory scale, vegetation characteristics were compared inside and outside of warbler territories.

Warbler density and shrub density were significantly positively correlated on all seven of the unmanipulated plots. Herbicide application reduced the shrub density by 76% on the experimental plot. This plot supported three entire and four partial warbler territories before treatment. Only two males defended territories within the plot (one entire and one partial) in the first and second years after treatment, and no warblers used the plot three years after treatment. These declines were well above the range of natural changes in warbler densities on an adjacent long-term study plot. Clearly, then, warbler density and distribution were affected by shrub density at the plot scale. Such was not the case at the territory scale, however. There was no difference in shrub density inside and outside of warbler territories, and discriminant function analyses showed only weak and inconsistent differences between vegetation characteristics of territories and adjacent areas.

Steele's explanation for this apparent contradiction is that Black-throated Blue Warblers defend large territories in areas of patchy shrub density. A territory in the appropriate habitat will contain many patches of dense shrubs separated by areas of very few shrubs. Because the warblers seem to need dense shrubs for nesting rather than for foraging, there may be no need for them to seek out high shrub densities so long as several dense patches are available within their territories. Consequently, habitat selection at the territory scale would be unnecessary. [Dept. of Natural Science, Colby-Sawyer College, New London, NH 03257, USA.]—Jeff Marks.

ECOLOGY

(see also 5, 8, 19)

14. Response of birds to wildfire in native versus exotic Arizona grassland. C. E. Bock and J. H. Bock. 1992. Southwest. Nat. 37:73-81.—From 1984-1990, the authors compared vegetation, fall birds, and summer birds in native versus exotic, and burned versus unburned grassland in Santa Cruz Co., Arizona. A wildfire in 1987 completely burned about 1000 ha of the study area. The fire significantly reduced grass cover through two years on both native and exotic sites. Total numbers of fall birds increased significantly during the first two post-fire seasons on both exotic ($P < 0.01$) and native ($P < 0.05$) grassland plots, probably as a result of increased seed availability. Fall species responding positively to the fire included Mourning Doves (*Zenaida macroura*), Horned Larks (*Eremophila alpestris*), Vesper Sparrows (*Pooecetes gramineus*), and Savannah Sparrows (*Passerculus sandwichensis*). Total numbers of summer birds also increased significantly during two of the four post-fire seasons on both exotic ($P < 0.01$) and native ($P < 0.05$) plots, but not during the two seasons immediately following the fire. Lark Sparrows (*Chondestes grammacus*), Mourning Doves, and Horned Larks were significantly more common for two to three post-fire years; however, numbers of Cassin's Sparrows (*Aimophila cassinii*), Botteri's Sparrows (*A. botterii*), Grasshopper Sparrows (*Ammodramus savannarum*), and Eastern Meadowlarks (*Sturnella magna*) dropped dramatically during the first two post-fire seasons. Generally, species responding positively to fire were negatively correlated with grass and litter cover, which was densest in exotic grassland plots. The effects of fire on both exotic and native grass and bird species were ephemeral with no evidence that it resulted in a permanent re-establishment of native flora or fauna on exotic sites. [Dept. of Environmental, Population, and Organismic Biology, Univ. of Colorado, Boulder, CO 80309, USA.]—Danny J. Ingold.

15. Relationships between fire and bird density in coastal scrub and slash pine flatwoods in Florida. D. R. Breininger and R. B. Smith. 1992. Am. Midl. Nat. 127:233-240.—A one-year study at the Kennedy Space Center in Brevard Co., Florida, was conducted to determine how the avian community varies with shrub height, percent area burned, time since fire, and snag density. The densities of Great Crested Flycatchers (*Myiarchus crinitus*), Blue Jays (*Cyanocitta cristata*), Florida Scrub Jays (*Aphelocoma coerulescens*), and Yellow-rumped Warblers (*Dendroica coronata*) were not significantly correlated with fire. Most shrub-dwelling birds, including Carolina Wrens (*Thryothorus ludovicianus*), White-eyed Vireos (*Vireo griseus*), and Common Yellowthroats (*Geothlypis trichas*) preferred unburned habitat (at least four years since the last fire). Conversely, numbers of Northern Bobwhites (*Colinus virginianus*), Red-bellied Woodpeckers (*Melanerpes carolinus*), and Northern Flickers (*Colaptes auratus*) were significantly correlated with the number of snags, which in turn was correlated to time since fire. The data suggest that frequent extensive burning of scrub and slash pine flatwoods (at least every four years) could have a negative influence on several shrub-dwelling birds. On the other hand, frequent burns may positively influence other species, including woodpeckers. [The Bionetics Corp., NASA Biomedical Operations and Research Office, Mail Code BIO-2, Kennedy Space Center, FL 32899, USA.]—Danny J. Ingold.

POPULATION DYNAMICS

(see 11, 17)

EVOLUTION AND GENETICS

(see 10)

PHYSIOLOGY AND DEVELOPMENT

(see 3, 20)

PLUMAGES AND MOLTS

(see 1, 2, 4)

WILDLIFE MANAGEMENT AND ENVIRONMENTAL QUALITY

(see also 15, 22)

16. Influence of selective logging on bird species diversity in a Guianan rain forest. J. Thiollay. 1992. Conserv. Biol. 6:47-63.—The effects of logged rainforest habitat on avian community structure and composition were determined in northeastern Amazonia. Point-counts were performed on 937 0.25-ha quadrats distributed in primay forests that had not been logged or were logged one or 10 years previously. Logged forests had an overall 27–33% decrease in species richness, frequency and abundance. Remaining dominant species, such as small frugivores or species associated with gaps, increased substantially in relative proportion. Over 40% of primary forest species decreased or disappeared after logging; this was correlated with microhabitat loss. Forest regrowth 10 years after logging produced a uniform habitat with a still depressed species richness. Maintenance of unlogged patches of forest may be necessary to allow persistence of sensitive primary forest species. [Lab. d'Ecologie, E.N.S., 73230 Paris Cedex 05, France.]—Kristin E. Brugger.

17. **Rarity and vulnerability: the birds of the Cordillera Central of Colombia.** G. H. Kattan. 1992. Conserv. Biol. 6:64–70.—A method for identifying and predicting patterns of extinction was evaluated using data from the forest avifauna of the Andean region of Colombia and the concept of rarity. Rarity was defined by three factors that affect vulnerability of a species: geographical distribution, habitat specificity, and population size. An index to vulnerability was assigned to each forest bird species by its position in the 3-dimensional rarity matrix. The three factors that affect rarity were found to be interdependent in the case of the Cordillera Central avifauna; these species are dependent on the humid forest habitat, which is declining in extent. Taxonomic and trophic correlates of vulnerability also were identified: large frugivores are prone to extinction due to restricted habitat specificity. The concept of rarity, as defined in the paper, emerged as a decisive factor for rapidly determining susceptibility of a species to extinction. Once vulnerable species are identified, then detailed studies of the natural history of the species would permit establishment of management programs. [Dept. of Zoology, Univ. of Florida, Gainesville, FL 32611, USA.]—Kristin E. Brugger.

18. **Is the operational use of strychnine to control ground squirrels detrimental to Burrowing Owls?** P. C. James, G. A. Fox, and T. J. Ethier. 1990. J. Raptor Res. 24: 120–123.—Burrowing Owl (*Athene cunicularia*) survival and productivity were studied in control and strychnine treated pastures in Saskatchewan in 1987. Breeding success (percent of pairs raising at least one chick), number of chicks produced per nest attempt, and chick mass were not significantly different between control and treated pastures. Owls were not observed feeding on dead or dying squirrels, although other nontarget species were observed doing so. However, mean adult mass was significantly higher on control sites, indicating a possible sublethal effect. The results of this study suggest that the use of strychnine is not lethal to Burrowing Owls when placed below ground. The authors caution that the continued removal of ground squirrels may be limiting to Burrowing Owl populations in the future due to their dependence on ground squirrel holes for breeding purposes. [Saskatchewan Museum of Natural History, Regina, SK S4P 3V7, Canada.]—Robin J. Densmore.

19. **European Staring–Eastern Bluebird nest site competition, IV.** P. A. Zerhusen. 1992. Sialia 14:55–58.—European Starlings (*Sturnus vulgaris*) were captured in a nest box trap and disposed of during five breeding seasons (March–August 1984, 1985, and 1989–1991) in the vicinity of a bluebird trail near Sykesville, Maryland. Of a total of 335 captured starlings ($\bar{x} = 51$ per year), 76% were adults, the majority of which were captured in March–May (91%). Sixty-four percent of these adults were males. From 1989–1991, the number of trapped adult starlings decreased from 53 to 51 to 39, which represents an 18.8% decrease over the previous low of 48 adult birds in 1984. These data tentatively suggest that repeated trapping and removal of starlings over consecutive nesting seasons may begin to reduce potential starling nest-site competition with Eastern Bluebirds (*Sialia sialis*). Finally, the author states that competition between starlings and bluebirds for available natural nest sites was intense, but provides no data to support this possibility. [12554 Indian Hill Dr., Sykesville, MD 21784, USA.]—Danny J. Ingold.

BOOKS AND MONOGRAPHS

20. **Egg incubation: its effects on embryonic development in birds and reptiles.** D. C. Deeming and M. W. J. Ferguson, eds. 1991. Cambridge University Press, Cambridge,

England. 448 pp. Hardcover (no price given).—This book is based on papers presented at the Conference on Physical Influences on Embryonic Development in Birds and Reptiles, held at the University of Manchester, England, in September 1989. The 37 participants were all leading authorities in these fields and all contributed written reviews of their presentations; these make up 27 chapters (10 of them jointly authored) variously illustrated with tables, graphs, diagrams, drawings, and photomicrographs. Fifteen chapters deal with both reptiles and birds, four with reptiles only, and eight with birds only. All chapters are extensively referenced, and some include citations dated 1991. The title of the conference is a more accurate indication of the material covered than the title of the book (emphasizing egg incubation) might suggest. The first eight chapters deal with pre-laying matters such as maternal diet, yolk formation and constituents, oviductal functions including materials secreted and their structure and function, and the determination of egg shape. Chapters 9 to 11 deal with thermal aspects of incubation; 13 to 17 with water and gas exchange; 18 to 20, in general, metabolism and energetics of embryos; 21 and 22, oviparity and viviparity, and the absence of the latter in chelonians, crocodilians, and birds; and 23 to 27, embryology and development, including experimental culture of shell-less embryos. Thus, there is a wealth of information for anyone with a serious interest in the biochemistry, biophysics, and physiology of egg formation and embryological development up to and including hatching in oviparous reptiles and in birds. Not surprisingly, these subjects have been studied much more thoroughly in birds as egg production and poultry-raising on a large commercial scale have provided abundant materials and also funding for study.

Although egg formation and development are much more uniform in birds than in reptiles, this book reminds us that there is a far greater diversity in birds' eggs and embryonic growth than would be supposed from the preponderance of data derived largely from *Gallus gallus*. Still, the greater variability among reptiles will surprise those familiar only with the usual avian sequential laying of eggs at 24-hour intervals and consistent incubation periods. In many reptiles, all the ova in a clutch are ovulated within a short period and enter the oviduct one after the other in rapid succession. Shelling of all eggs in the clutch takes considerably longer than 24 hours. Eggs of different species within the same reptilian order may have either rigid calcareous shells or flexible parchment-like shells that may take up considerable water if laid in wet places and thus produce larger hatchlings. The environmental temperature of incubation may determine the sex of the developing embryos (see Chapter 10 for discussion of possible causal mechanisms). Alternatively, considerable embryonic development may take place before eggs are laid, so that they hatch as little as four days after laying, or, in viviparous species (some lizards and snakes only), they develop with a placenta in utero. All reptilian eggs produce precocial young ready to fend for themselves, as dramatically exemplified by marine turtle hatchlings that burrow up out of the sand and then head directly into the sea and swim away.

Alfred S. Romer called the cleidoic (shelled) egg "the most marvelous single 'invention' in the history of vertebrate life," and the avian egg especially qualifies as one of nature's miracles. It starts as a single cell in the ovary. Under complex hormonal control it accumulates yolk (often within only a few days) that contains organic and inorganic matter (including trace elements) in exactly the right quantities and proportions for future embryonic growth. The oöcyte nucleus commences a reduction division that provides the haploid number of chromosomes. The ripe ovum ruptures out of the ovarian follicle, momentarily free but quickly engulfed by the oviduct, where spermatozoa may await it; if so, a single one will unite its chromosomes with their homologues in the oöcyte. In as little as 24 hours, the fertilized ovum is enswathed in layers of albumen containing nutrients and water, then two complex membranes made up of protein fibers arranged into a precise porous structure that (after laying) permits passage of O_2 in and CO_2 and H_2O vapor out (at just the right rate), and then a suitable porous calcareous shell which may also be species specifically pigmented in a uniform, random, mimetic, or highly cryptic pattern. The egg is then laid and incubated at a relatively constant temperature. As water vapor is lost, an air cell forms inside the shell from which the unhatched chick may begin to ventilate its respiratory system. In as little as 11 days post-laying, an altricial chick may peck its way out of the shell and respond at once to parental care and feeding. Alternatively, a precocial chick may develop to a more advanced state in a more bountiful egg and hatch ready to walk, run, swim, forage, or even fly (megapodes).

In their preface, the editors state that "The book should be of value to a wide range of individuals: developmental biologists, zoologists, commercial incubation and breeding establishments, zoos, conservationists, wildlife managers, evolutionary biologists, herpetologists, physiologists, biochemists, the enlightened hobbyist, and a variety of graduate students." I agree, and although ornithologists are not specifically mentioned, its value to them is self-evident. It may be useful to potential purchasers to be aware of what topics relating to avian reproduction are not covered. These include: hormonal control of gonadal development and of gametogenesis; courtship, copulation, spermatozoa, and fertilization; bird's nests (except megapodes); eggshell pigmentation; clutch size and its determination; hormonal control of incubation patch information (or its absence, as in pelecaniforms) and its histology; the role of each sex in avian incubation; details of embryonic excretion; and of course, almost anything post-hatching. Egg formation and incubation in the extant oviparous mammals (Monotremata: platypus and echidnas) are not included, but there is mention of their eggs' small size and possible role in the evolution of viviparity. To point out these omissions is not a negative criticism; these subjects were simply outside the scope of the conference, which focused on the events and processes that take place in the ovary, the oviduct, and the egg itself.

The contributing authors most familiar to readers of ornithological publications that treat eggs and incubation include the late Hermann Rahn and his collaborators C. Paganelli and A. Ar, and David and Carol Vleck and Donald Hoyt, who also worked with Rahn. Their chapters deal with the roles of water, water ecomony, and solute regulation, gas exchange through the shell, and metabolism and energetics of the embryo. Rahn's Chapter 21, "Why birds lay eggs," addresses the question why the class Aves, with thousands of species occupying a huge diversity of habitats, is alone among vertebrates in having no viviparous forms. He points out that endothermic birds can maintain their eggs and the enclosed embryos externally at constant temperature, with suitable acid–base balance and hydration, can store nitrogenous wastes as insoluble uric acid, and can aerate their lungs before hatching. Given these advantages, what selection pressures would favor viviparity, especially in volant species that may produce large clutches? It is tempting to speculate on whether or not many human reproductive problems could be better managed if oviparity were an option. R. Shine (Chapter 22) agrees with Dunbrack and Ramsay (1989, Am. Nat. 133:138–148) that proto-viviparous mammals first evolved small eggs with little yolk (unlike reptiles) along with nourishment of altricial hatchlings by lactation, instead of precocial hatchlings nourished to that stage by large yolks. The marsupial state (live-born altricial young, more advanced lactation) and then the eutherian (placental) condition followed.

Not only these, but every chapter is of potential value to anyone interested in oviparous reproduction in reptiles and birds. To mention only two others of special interest to ornithologists, D. T. Booth and M. B. Thompson (Chapter 20) compare reptilian eggs and those of megapode birds, and Ruth Bellairs gives a fine "Overview of early states of avian and reptilian development" (Chaper 23). Some chapters such as 9 (J. S. Turner, "The thermal energetics of incubated bird eggs") and 25 (P. O'Shea, "Electrochemical processes during embryonic development") demand a substantial scientific background for full understanding. After all, the conference on which this book is based was of and for professional biologists who were addressing each other. As stated in the preface, "this book . . . aims to be a comprehensive review of relevant reptilian and avian embryonic data: a text designed as a reference guide for the next few years." The coverage is actually broader than that, and the book serves its purpose well.—Thomas R. Howell.

21. The little green bird: ecology of the Willow Flycatcher. R. A. McCabe. 1991. Rusty Rock Press, Madison, Wisconsin. 171 pp. $35.00, hardcover.—A synthesis of the ecology of the Willow Flycatcher is long overdue. Until 1973, the Willow (*Empidonax traillii*) and Alder Flycatchers (*E. alnorum*) were considered to be a single species, the Traill's Flycatcher. It is now generally accepted that these species differ not only in song form, but also (despite much overlap) in distribution, habitat selection, and behavior. Information specific to either species often has been difficult to extract from pre-1973 references which refer only to "Traill's" Flycatcher. Thus, a synopsis of the biology of a single member of the Traill's Flycatcher complex should be welcomed by many ornithologists.

This book is handsomely assembled, and is interspersed with black and white photographs and attractive line drawings by Steve Hovel. McCabe covers a broad range of topics, including taxonomy, distribution, migration, song, food habits, and conservation. Not surprisingly, most chapters are dedicated to aspects of the breeding biology, including territories, habitat selection, nests and eggs, cowbird parasitism, and renesting. "Nonbreeding" chapters draw heavily on literature accounts. In many cases, references to nonbreeding biology have been gathered from publications which are of a regional nature, are more than 50 years old, or have been extracted from larger works which are not specific to flycatchers. McCabe has done a service in bringing these little known references to the attention of readers.

My first impressions of this book were tainted when I found, on p. 12, maps showing that the breeding range of the "Willow" Flycatcher stretches from northern Mexico to the edge of the arctic tundra. This map obviously represents the combined breeding ranges of the Alder and Willow Flycatchers. The reasons for this depiction became evident in the "Taxonomy" chapter, where the author makes it clear that he is skeptical of the taxonomic distinctions between the two species. Given this, it is difficult to determine whether many of the literature citations to "Willow" Flycatchers are specific to this species or not. The reader should therefore be cautioned that this book no doubt contains much information which pertains to the Alder Flycatcher (especially in chapters concerning nonbreeding biology, when these species cannot readily be distinguished).

Chapters covering the breeding biology of the Willow Flycatcher are primarily summaries of (mostly) unpublished work conducted by the author in Wisconsin since the 1940s. This work clearly focuses on the Willow Flycatcher, and readers will find much useful information on various aspects of the reproductive behavior of this species. In particular, descriptions of clutch size variation, nestling growth, parental care, and nest-shrub selection add substantially to our knowledge of Willow Flycatcher biology. Despite the claim that "... all numerical data were computerized and machine-analyzed statistically" (page ix), most of the data are presented in a descriptive manner. When statistical tests are presented, sufficient information to assess the validity of each procedure usually is not provided. This, combined with the scant (frequently by the author's own admission) data used to support many arguments, make many conclusions highly speculative. For example, it is stated in several places that food limitation and competition play no role in the ecology of the Willow Flycatcher, but nowhere are data provided to support these claims. Other such examples (e.g., the influence of female age on clutch size, mechanisms of habitat selection) are numerous. It is ironic that, in many instances throughout the book, the author is sharply critical of the conclusions of researchers who have taken a strongly quantitative approach to studies of the Willow Flycatcher. Such ecologists are accused of "data squeezing and extrapolation" (p. 7), and of thinking that "lacks evidence and is singularly unconvincing" (p. 96), or that is "not very enlightening" (p. 121). These criticisms are both unfortunate and unnecessary, particularly when refutive data are rarely provided.

The author's aversion to "modern" ecological research is evident throughout the book. It is perhaps for this reason that many recent references to the ecology of the Willow Flycatcher have been overlooked. These references include quantitative assessments of foraging behavior and diet, territoriality, incubation, interspecific relationships, mating systems, genetic relationships with other tyrant flycatchers, population trends, and more general references to breeding biology. As such, this book should not be considered to be a comprehensive synthesis of information on the ecology of the Willow Flycatcher. Rather, it serves as a broad introduction to the biology of this fascinating species, and as an indication that many aspects of the species' biology remain poorly understood.

In addition to the errata sheet provided by the author (12 errors), I noted nine typographical mistakes in the body of the text. One other inconsistency is the tendency to provide either (or both) metric or imperial units in tables and figures, while all units in the text are given in imperial units and their metric equivalent. Despite these minor oversights, the book generally is well written and organized. McCabe's fluid and colorful writing style will appeal to naturalists and scientists alike, and will introduce the "Little Green Bird" to many readers to whom it might previously have been unfamiliar. Interested readers should make plans to purchase this book without delay, because only 750 copies are available in this limited printing.—David R. C. Prescott.

22. New World parrots in crisis: solutions from conservation biology. S. R. Beissinger and N. F. R. Snyder, eds. 1992. Smithsonian Institution Press, Washington, D.C. 304 pp. $35.00, hard cover; $16.95, soft cover.—1981 saw the publication of R. F. Pasquier's *Conservation of New World parrots,* which was the result of the first major conference convened to cover New World psittacines. The New World Parrot Symposium at the AOU's 1990 meeting in Los Angeles 10 years later has produced a new book edited by Beissinger and Snyder. The Los Angeles symposium was called to assess the effectiveness of parrot conservation during these last 10 years and to discuss a resolution submitted to the AOU in 1989 to ban the importation of all exotic birds into the United States. The outcome of this latest symposium is a very thorough and thought provoking book.

After a forward by J. M. Forshaw and an introduction by Beissinger and Snyder, the book is divided into 11 sections which are written by most of the best known New World parrot researchers of the 1980s. Chapter 1, "Dimensions and causes of the parrot conservation crisis," by N. J. Collar and A. T. Juniper, discusses some sobering statistics. Forty-two of the 140 species of New World parrots are considered at risk of extinction and two macaw species have recently disappeared from the wild. The authors go into a brief review of where these endangered parrots are located and the known causes of their population declines. They conclude that 17 species are endangered primarily by habitat destruction, 15 by habitat loss and the impact of trapping for the pet trade, seven mainly from trade pressures, and three by unknown causes. They conclude with a brief discussion on each of the 42 parrot species considered at risk by the ICBP.

Chapter 2, by P. J. Butler, is titled "Parrots, pressures, people, and pride." Butler tackles the problems facing the parrots of the Lesser Antilles. Of the 14 parrot species that existed in this region at the time of Columbus's landing, only four remain and these are in danger of extinction. Butler describes the RARE Center for Tropical Bird Conservation's work with the people and governments on the islands of Saint Lucia, Saint Vincent, and Dominica. Using national pride as the focus of intense education, remarkable results have been achieved, especially on Saint Lucia, where parrot numbers are increasing. The author discusses the potential for using national pride elsewhere. The importance of education can never be overemphasized and Butler's paper clearly shows how effective it can be in a short period of time.

C. A. Munn covers ecotourism in Chapter 3's "Macaw biology and ecotourism, or 'when a bird in the bush is worth two in the hand.' " Since 1985, Munn has been carrying out the most intensive study of macaws ever attempted. Working at clay licks in Peru, he found one lick that was visited by at least 356 different macaws. Utilizing licks as a focal point for tourists, Munn calculated that each free-flying macaw at this lick could potentially generate $22,500 to $165,000 in tourist money during its lifetime; if done right, most of this money would be going to local people. Munn delves into the problems and successes of tourism centered around clay licks. He does not gloss over the pitfalls but shows this to be an area ripe for future implementation in some South American countries.

Chapter 4 is arguably the most controversial section in the book. Titled "Sustainable harvesting of parrots for conservation," its authors, S. R. Beissinger and E. H. Bucher, discuss the possibility of sustainable harvesting of parrots to benefit the local human population and to curb the overharvesting of many species. They propose a "Conservative Nestling Harvest Model" to set sustainable levels for selected species not in danger of extinction or currently being overexploited. They detail what biological data are needed before the model can be implemented, but they also recognize that these data are lacking for most species. They are not shy about covering the problems of getting this model to work. I was not entirely convinced that harvesting can be kept at a level that does not decrease population numbers, but I found this chapter to be particularly stimulating.

S. L. Clubb discusses "The role of private aviculture in the conservation of Neotropical psittacines" in Chapter 5. This is an area often overlooked by ornithologists due to the difficulties of working with private pet owners, breeders, and zoos. Private aviculturalists are a source of birds for reintroduction programs and are a potential place to raise funds for field work. Bringing conservationists and aviculturalists together will not be easy, but the alternative is another wasted resource.

Chapter 6 is titled "Potentials and limits of captive breeding in parrot conservation," and is written by S. R. Derrickson and N. F. R. Snyder. This detailed chapter covers the plusses and minuses associated with captive breeding programs undertaken so far. Emphasizing the need to discover what caused a species to decline in the first place, the authors explain that sometimes captive propagation is the last hope for a species. Recognizing the considerable effort and expense of captive programs, they review its possible application to parrots.

Chaper 7 covers "Reintroduction as a conservation strategy for parrots." J. W. Wiley, N. F. R. Snyder, and R. S. Gnam examine previous parrot reintroductions and translocations attempted in the past. They make a good case for trying translocations first, to maximize the potential for success of a reintroduction program. This eliminates many of the problems associated with captive bred birds. This chapter has numerous ideas which are applicable to reintroduction programs for many species.

E. H. Bucher discusses "Neotropical parrots as agricultural pests" in Chapter 8. Bucher describes what happened when Argentina allowed unrestricted exportation of nearly all parrot species under justification of their pest status. Between 1982 and 1988 over 900,000 parrots were taken out of the country. Pest control is an area that is just beginning to be recognized as a problem and may be a greater factor in parrot declines than previously believed. Bucher shows the need for increased testing of nonlethal methods of pest control.

J. B. Thomsen and T. A. Mulliken tackle "Trade in Neotropical psittacines and its conservation implications" in Chapter 9. Between 1982 and 1988 at least 1.8 million parrots were legally exported from the Neotropics, and this is just a fraction of the number of birds illegally smuggled. The 1.8 million legally exported parrots had an estimated retail value of $1.6 billion. Since population numbers of most parrot species are unknown, it is hard to assess the impact of exporting, but it is clearly more than many species can handle. The authors rightly point out that as long as Europe and the United States show a demand for New World parrots, Latin American countries will continue to supply the product. Clearly, a lot of parrot conservation work begins at home.

A transcript edited by F. C. James forms the basis of Chapter 10's "Roundtable discussion of parrot trade problems and solutions." In this section, 15 of the world's foremost parrot biologists discuss the problems associated with the parrot trade. There was a general call for a time-limited ban in the parrot trade until more information is collected on wild population numbers, at least for some species. It was a lively discussion that unfortunately lasted for only one hour, so few solutions were agreed upon. However, it shows clearly how hard it is for even the best minds to solve problems when so little scientific data has been collected in the field.

The book ends with a final chapter by N. F. R. Snyder, F. C. James, and S. R. Beissinger, titled "Toward a conservation strategy for Neotropical psittacines." They review what has been accomplished since the publication of Pasquier's 1981 book. At least two species of psittacines have gone extinct in the wild and the ICBP list of endangered parrots has jumped from 23 to 42. Only a few species are actually increasing in numbers. The authors give a concise review of the solutions outlined in the previous chapters. As usual, the number one recommendation is to set aside more land for wildlife preserves. They conclude on a note of optimism, which after having read about the enormity of the problem, I am unable to share.

Beissinger and Snyder are to be congratulated on putting together such a thorough and timely book about a group of birds that have often been neglected in the past. I've read it from cover to cover twice in the week since I received a copy. The editing was excellent, as I found only one typographical error. The index at the end is very useful. The styles of writing stay light enough that the nonscientist will also get much out of it. A welcome touch is the addition of abstracts in English and Spanish for each chapter. However, I would have liked to have seen more papers from Latin American ornithologists. I highly recommend this book to all those interested in New World parrots and those who would like a provocative discussion on various methods available to help stem the decline of Neotropical wildlife populations.—Steven M. McGehee.