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RECENT LITERATURE

Edited by Danny J. Ingold

RESEARCH TECHNIQUES

(see also 2, 18, 30)

1. Color change in plastic leg bands complicates identification. [Barbveranderungen bei farbigen Vogelringen beeintrachtigen die Identifikation.] T. Rodl and H. Flinks. 1998. Vogelwarte 39:226–228. (German, English summary)—In a long term study on Stonechats (*Saxicola torquata*) in Germany and the Negev desert of Israel, the authors found that plastic leg bands would change color in as little as 200 days. Light blue bands changed to light green and pink bands changed to a dirty white. Dark brown, dark blue, and dark green became almost black. This paper should serve as a warning to researchers involved in long term studies on color-marked populations to test the effect of exposure to weather on their bands to prevent misidentification of individuals. [Max-Planck-Inst. fur Verhaltnesphysiologie, D-82346 Andechs, Germany.]—Robert C. Beason.

BEHAVIOR

(see also 7, 9, 10, 13, 20, 28)

2. Behaviour in the post-nestling dependence period of radio-tagged Common Buzzards *Buteo buteo*. A. J. Tyack, S. S. Walls, and R. E. Kenward. 1998. Ibis. 140:58–63.—The authors used radio-tracking to observe Common Buzzard nestlings leaving their nests. Most fledged at 43–54 days of age and began to venture from the nest almost immediately; however, the distance that the chicks traveled rarely exceeded 500 m until they reached approximately 65 days old when they began to travel up to 2000 m from the nest. The buzzards were studied in two different sessions: one when the mean age of the chicks was less than 65 days old, and the other when the mean age was greater than 65 days. For chicks less than 65 days old, older chicks tended to have much larger ranges than younger chicks, and chicks traveling far from the nest tended to have parents present in the area. Also, chicks traveled farther away from the nest in areas with the least surrounding grasslands. These tendencies decreased when the mean age of the chicks was greater than 65 days. The authors also studied the sociality of the species by recording the birds' interactions as they mature. This study was effectively undertaken and explored several hypotheses, including whether broods with parents that feed and guard their young more frequently will have young that fly farther from their nests versus young with less competent parents. [The Limes, Linby, Nottingham NG15 8AE, UK.]—R. Todd Steinmetz.

3. Deception by helpers in cooperatively breeding White-winged Choughs and its experimental manipulation. C. R. J. Boland, R. Heinsohn and A. Cockburn. 1997. Behav. Ecol. Sociobiol. 41:251–256.—White-winged Choughs (*Corcorax melanorhampos*) are cooperative breeders that are constrained by food limitations to the point that they are considered to breed in groups out of necessity. Such groups may include up to 20 birds, some of which have been reported to return to the nest without food items or have failed to feed nestlings with food that they have carried to the nest. The authors examined the potential failure of young White-winged Choughs to provide nestlings with food that they had carried to the nest in food-supplemented and control groups during one breeding season in Australia. False-feeding in which the provider ate its own food occurred significantly more often in control groups (11%) than in food-supplemented groups (2%). The probability that an individual would fail to deliver food differed significantly among age classes. Two-year old birds in control groups failed to provision nestlings with food in 30% of their visits. Conversely, older birds became progressively more likely to surrender the food they delivered to nests. In addition, the chances that a provider would fail to deliver the food to nestlings decreased significantly ($P < 0.001$) as the nestlings approached fledging. False-feeding in control groups occurred in 50 of 387 visits (13%) by a single bird and in 8 of 35 visits (23%) by two or more birds; in experimental groups false-feeding was quite rare irrespective of whether the visit was by one or more than one bird. The authors list several reasons why they believe false-feeding in White-winged Choughs conveys a deceptive message to the other providers in the group, including the idea that young birds suffer from significant physiological stress by helping

since they have limited foraging skills. Their data support this notion since false-feeding peaked in two-year old birds and decreased rapidly with age. The authors then summarize several adaptive advantages that choughs may obtain by engaging in this deceptive behavior including the traditional explanations posed by Emlen et al. (Am. Nat., 1991) that provide direct benefits to the helper (e.g., helpers have enhanced access to resources or a better chance to mate if the breeder dies). In any case, the authors suggest that the same selection pressures that have led to the evolution of cooperative breeding in this species (out of necessity) have also, perhaps in an ironic twist of fate, led to the evolution of habitual cheating. [Evolutionary Ecology Group, Div. of Botany and Zoology, Australian National Univ., Canberra, ACT 0200, Australia; e-mail: Andrew.Cockburn@anu.edu.au]—Danny J. Ingold.

4. The relationship between social stress and dominance is seasonal in Greylag Geese. K. Kotrschal, K. Hirschenhauser, and E. Mostl. 1998. Anim. Behav.55:171–176.—An inverse relationship between dominance and stress has generally been shown when studying captive animals. Using non-invasive sampling methods, recent studies contradict these findings and reveal dominant individuals may be more affected by social stress than are subordinate individuals. Analyses of fecal corticosterone equivalents in Greylag Geese (*Anser anser*) (12 singletons, 13 paired males with offspring, 18 paired males without offspring) were conducted to determine how seasonal social changes may affect stress in males of different social rank. All categories of males had higher corticosterone levels during the mating season than outside, with singletons having higher levels than paired males. Dominant males (paired males with offspring) had higher stress hormone levels throughout the parental season than did intermediate males (paired males without offspring) and subordinate males (singletons). Intermediate males and subordinate males did not differ in stress hormone levels during the parental season. The authors suggest that social stress in gander Greylag Geese is not caused by limited access to females during the mating season, but by parental effort during the rest of the year. [Konrad-Lorenz-Forschungsstelle fur Ethologie, A-4645 Grunau 11, Austria; e-mail: klf.gruenau.@tellcom.at.]—Jeffrey P. Duguay.

5. Feather pecking in domestic chicks: its relation to dustbathing and foraging. B. Huber-Eicher and B. Wechler. 1997. Anim. Behav. 54:757–768.—One problem critical in poultry housing is feather pecking. In domestic chicks, *Gallus gallus domesticus,* such pecking results in damage to feathers, bodily injuries, and even death. Using 1260 white layer chicks, two hypotheses were tested. The first hypothesis suggested that if a chick does not have access to dustbathing material, it will direct its dustbathing behavior toward the feathers of conspecifics. The results showed that even with sand present, the chicks continued to peck at the feathers of conspecifics. The second hypothesis states that if a chick had little or no litter available on the ground for foraging, it would begin pecking at particles on the plumage of conspecifics. As predicted, the results showed a significant decrease in feather pecking after the introduction of straw as a foraging material. As Huber-Eicher and Wechler point out, housing systems should promote foraging behavior. However, further experiments are necessary to determine the features of the material that prevented the chicks from pecking at the feathers of conspecifics. This study seems to be one which can yield practical results. Once the appropriate material is found, it will be very useful in poultry housing. [Abteilung Sozialund Nutztierethologie. Zoologisches Institut, Universitat Bern, Ethologische Station Hasli, Wohlenstrasse 50a., 3032 Hinterkappelen, Switzerland.]—Carla Diorio.

6. The down-up display of the Mallard: one display, two orientations. E. S. Davis. 1997. Anim. Behav. 53:1025–1034.—Orientation, shape, and movement are important to the communication of information. One of the important courtship displays of the male Mallard, *Anas platyrhynchos,* is the down-up display. Upon analyzing 252 display bouts, Davis concludes that the down-up display may have more than one function. The results showed that when a male gave the first down-up display, it was orientated broadside to the female, suggesting a courtship role. However, subsequent down-up displays in the same bout, but from other males seem to be directed at the first male to display, not the female. It is a reaction of one male to another and, therefore, seems to represent communication between males. These findings help to explain the patterns of Mallard social displays. With this information, many data previously thought to be inexplicable are now meaningful. For example, previous studies on mate choice grouped these down-up displays as one. This new information will help

distinguish among the various functions of this behavior. Davis's research is important in understanding courtship displays of not only Mallards, but in other ducks as well. Further research can now be conducted, with increased awareness that an animal's orientation during courtship and other social displays may affect the message. [Dept. of Zoology, Univ. of Wisconsin, B142 Birge Hall, Madison, WI 53706, U.S.A.]—Carla Diorio.

FOOD AND FEEDING

(see also 3, 5, 16, 18, 20, 21)

7. Diet of Common Nighthawks (*Chordeiles minor:* Caprimulgidae) relative to prey abundance. L. D. Todd, R. G. Poulin and R. M. Brigham. 1998. Am. Midl. Nat. 139:20–28.—Optimal foraging theory predicts that as prey abundance decreases the selection of prey becomes less discriminating with prey consumed in relation to its abundance. The authors attempted to test this hypothesis by studying Common Nighthawks foraging in the Cypress Hills Provincial Park, Saskatchewan during May–August 1995. Comparison between nighthawk diet and insect abundance indicated that the nighthawks were still selective in their prey choice, which contradicts optimal foraging theory. The authors suggest that nighthawks may employ selective feeding through habitat choice rather than prey selection. [Biology Dept., Univ. of Regina, Regina, Saskatchewan S4S 0A2, Canada; e-mail: poulinr@meena.cc.uregina.ca]—Tom Leiden.

8. Diet of the Red-cockaded Woodpecker in the Apalachicola National Forest. C. A. Hess and F. C. James. 1998. J. Wildl. Manage. 62:509–517.—This study examined the relationship between diet and variation in habitat for Red-cockaded Woodpeckers (*Picoides borealis*; RCW). The authors used a nondestructive technique of stomach flushing to determine if diet differed by sex, age, season, or the burn history of the habitat for adult and nestling RCWs. Adult RCWs ate primarily arthropods (75% of the total biomass) and a large proportion of their diet (58%) consisted of ants. The ant *Crematogaster ashmeadi* was a major component of the diet; 74% of all ants eaten belonged to this species. Adult males ate a higher proportion of ants in the winter and summer as compared to adult females. In addition, both sexes ate very few fruits and seeds during the spring as compared to all other times of the year. Nestling diets were comprised primarily of arthropods. Spiders, ants, beetles, beetle larvae, and centipedes were equally important components of the nestling diet. Ant availability was examined at 3 sites with low fire frequency and 3 sites with a higher fire frequency. The abundance of *C. ashmeadi* was consistently lower in frequently burned sites. In addition, the stomach samples from males in frequently burned sites had a lower proportion of ants (including *C. ashmeadi*). The authors suggest that differences between adult and nestling diets may be due to differences in nutritional composition of the various arthropods. In addition the authors suggest that fire had an effect on the prey base, and that further studies might examine the relationship between diet, habitat heterogeneity and demography. [Dept. of Biological Science, Conradi Building, Florida State University, Tallahassee, FL 32306, USA.]–Kerri T. Vierling.

9. The food and chick feeding of Black-bellied Storm-Petrels (*Fregetta tropica*) at King George Island, South Shetlands. S. Hahn. 1998. Polar Biol. 19:354–357.—The diet and chick feeding rate of the Black-bellied Storm-Petrel in an Antarctic colony are documented for the first time in this paper. Hahn compared stomach contents from spontaneously regurgitated samples and samples obtained with water offloading. He found significant differences in the percent of prey taxa recorded between these methods and thus based his analysis on data from regurgitations. Fish occurred in 53% of the samples and were the main prey item, followed by crustaceans, found in 50% of the samples. The author also found no variation in food composition between breeding and non-breeding birds or between birds at different stages of the breeding cycle. Krill (*Euphausia* sp.) were found in only 21.7% of the samples which the author suggests demonstrates separation of food preferences from the sympatrically breeding Wilson's Storm-Petrel. The author also determined that ~1 feeding event occurred each day, suggesting that long feeding trips were rare. Meal sizes ranged from 9.2 to 11 g. Finally, the author suggests that regurgitates were biased samples of the diet and recommends further research combining regurgitates and stomach flushing to further doc-

ument the diet of this species. [Institute of Ecology, Dornburger Strabe 159, D-07743 Jena, Germany; e-mail: b6hase@grasshopper.oekologie.unei-jena.de.]—John C. Carlson.

10. Luxury in freshwater and stress at sea? The foraging of the Common Tern *Sterna hirundo*. P. H. Becker, D. Frank, and M. Wagner. 1997. Ibis 139:264–269.—Pairs of Common Terns that nest by freshwater lakes have a constant food supply close to the colony which allows parents to make short foraging trips and minimize their time away from the nest. By contrast, terns nesting on the seacoast have long foraging trips and are away from the nest for long periods. Foraging terns nesting inland are limited only by daylight, whereas terns nesting on the sea coast are limited by daylight and tidal cycles. Increased time away from the nest reduces defense of the nest against predators, which may account for higher nest predation rates of terns nesting on the coast. Foraging efficiency may also favor inland terns which make frequent short foraging trips, compared to coastal terns which make fewer long trips. Data on weight gain compared to time away from the nest supports this hypothesis. Sample sizes are sufficient, although replication over successive seasons would have been desirable. The conclusions in this study should be regarded carefully. Total time per day that both parents were at the nest is missing, and would have been useful to determine if nest predation rates are lower when two parents defend the nest. Furthermore, the inland terns nested near and used a farm pond for foraging versus a natural lake. The conclusions fail to emphasize the differences in food availability between inland and coastal terns. [Institut fur Vogelforschung, "Vogelwarte Helgoland," An der Vogelwarte 21, D-26386 Wilhelmshaven, Germany]—Andy Johnson.

SONGS AND VOCALIZATIONS

(see also 30)

11. Song rates of Dark-eyed Juncos do not increase when females are fertile. R. C. Titus, C. R. Chandler, E. D. Ketterson, and V. Nolan Jr. 1997. Behav. Ecol. Sociobiol. 41:165–169.—The "fertility-announcement hypothesis" proposed by Møller (Am. Nat., 1991) predicts that in song birds in which males guard their mates, male song rates should peak during their mate's fertile period, and that increased song rates will deter or discourage potentially intruding males. The authors employed focal watches, point counts and radiotelemetry to test the fertility-announcement hypothesis in Dark-eyed Juncos (*Junco hyemalis*). Specifically they tested whether song rates are higher when the mates of male juncos are fertile and when neighboring females are fertile. Song rates did not differ significantly in males with fertile mates versus those with mates that were presumed not to be fertile, regardless of which method was used for data collection. Moreover, song rates of male juncos were not higher when neighboring females were fertile. These data refute the fertility-announcement hypothesis since males did not advertise their intent to defend their territories more vigorously when their mates were fertile. The data also suggest that male juncos do not use song to attract neighboring fertile females to solicit extra-pair copulations. The authors suggest that constant high-amplitude songs by male Dark-eyed Juncos may in fact conceal the receptivity of their mate or make it more difficult for neighboring males to obtain information regarding their fertility. [Dept. of Biology, Indiana Univ., Bloomington, IN 47405, USA; e-mail: rtitus@iubacs.]—Danny J. Ingold.

12. Two-note syllables in Canary songs elicit high levels of sexual display. E. Vallet, I. Beme, and M. Kreutzer. 1998. Anim. Behav. 55:291–297.—Male song has been demonstrated to play a role in mate attraction, but little is known about which acoustic features in male song attract females. The authors conducted a play-back experiment using a two-note Canary (*Serinus canaria*) syllable from the 'A' song phrase from eight male repertoires. Female response to the two-note syllable was compared to two controls: a Greenfinch (*Carduelis chloris*) song and a natural Canary song phrase produced by repeating one-note syllables. Female Canaries performed significantly more copulation displays to 5 of the 8 two-note syllable songs than to either of the control songs. The authors concluded that special acoustic features are required to make two-note syllables sexually attractive and some two-note syllables may lack these features. It was suggested that rapid two-note syllables provide information about the singers condition to the female. [Laboratoire de Psycho-physiologie et d'Ethologie, U.R.A. C.N.R.S. 2214, Universite Paris X-Nanterre, 200 Avenue de la Republique, 92001 Nanterre Cedex, France; e-mail: vallet@leec.univ-paris13.fr.]—Jeffrey P. Duguay.

13. Nest-vicinity song exchanges may coordinate biparental care of Northern Cardinals. S. L. Halkin. 1997. Anim. Behav. 54:189–198.—Singing in nesting female Northern Cardinals (*Cardinalis cardinalis*) may function to inform mates as to whether food is needed. If so, this would greatly decrease the conspicuous male's number of unnecessary trips to the nest. Halkin proposed that the probability of a male bringing food to the nest was dependent on the female's song. Song data were recorded for five summers from thirteen pairs nesting in a nature preserve near Madison, Wisconsin. Halkin found that the response vocalizations of females seemed to predict their mates' behavior. If the female sang in response to a call from her mate, he was more likely to approach the nest than if she did not sing. Females that specifically matched their mates' initial songs significantly decreased the males' probability of visiting the nest. These results support the hypothesis that singing in nesting females relays food status information to foraging males. However, the small sample size for the data on song matching may have biased these results. [Dept. of Biological Sciences, Central Conneticut State Univ., New Britain, CT 06050, USA; e-mail: holkins@ccsu.ctstateu.edu]—R. K. Zinsser.

NESTING AND REPRODUCTION

(see also 3, 5, 9, 10, 22, 24, 27)

14. Synchronous breeding: Wedge-tailed Shearwaters *Puffinus pacificus* in Western Australia. P. K. Dyer and J. L. Carter. 1997. Emu 97:305–309.—In this paper the authors correct information concerning the breeding ecology of the Wedge-tailed Shearwater. Previous data from the Indian and Pacific Oceans in both the northern and southern hemispheres suggested that this species exhibited synchronous breeding throughout their range. The authors determined that Wedge-tailed Shearwaters nesting along the eastern coast of Australia do not exhibit synchronous breeding. They documented egg laying at a colony on Heron Island to be more protracted than previously thought. They also found that birds at lower latitude colonies along the eastern coast of Australia arrived later than birds at higher latitude colonies, although laying times were similar. Wedge-tailed Shearwaters are recorded as summer breeders in both hemispheres; however, here the authors suggest that the timing of breeding of individuals in colonies located in northern Australia is intermediate between the time recognized for colonies in each hemisphere and may represent a transitional state between "true" southern hemisphere and northern hemisphere populations. Because these birds are not as common as previously thought and because of their protracted breeding cycle, the authors feel that this species is more susceptible to human disturbance than is currently recognized. The authors suggest that this research has raised more questions than it has answered and they encourage further research examining egg laying dates throughout this trans-hemispheric species' range. [Sunshine Coast Univ. College, Sippy Downs Drive, Sippy Downs, Qld 4556, Australia.]—John C. Carlson.

15. Nonbreeding and nests without eggs in the Lesser Black-backed Gull (*Larus fuscus*). M. J. O'Connell, J. C. Coulson, S. Raven, and S. Joyce. 1997. Ibis. 139:252–258.—At the Tarnbrook Fell gullery in Lancashire, Great Britain, the population of Lesser Black-backed Gulls was estimated annually by counting the number of nests and multiplying by two (two breeding gulls per nest). If the nest was empty at the time of the census, it was assumed that in the days following, the nests would eventually contain eggs. In 1992, however, repeated checks showed that these "empty nests" usually did not subsequently contain eggs. Data from 62 pairs of gulls showed that some nests never had eggs and that many pairs of gulls claimed more than one nest, sometimes up to four. These data invalidate the previous method of nest censusing and indicate that the gull population since 1981 has been overestimated. The authors suggest that a correction multiplier of 0.61 must be applied to all gull counts since 1981. Further, the authors investigated the behavior of the birds and the relationship of certain behaviors, such as the timing of nest building and territorial occupation, in birds with and without a clutch in their territory. They also, noted a difference between the percentage of empty nests at the Tarnbrook Fell gullery (64%) and the percentage of empty nests at Walney Island gullery (2%), only 40 km west of Tarnbrook. The authors did not fully explain the reason for including this information, or the implication this difference may have had on their study. [Dept. of Biological Sciences, Univ. of Durham, South Road, Durham DH1 3LE, UK.]—R. Todd Steinmetz.

16. Costs and benefits of surplus offspring in the Lesser Kestrel (*Falco naumanni*). J. M. Aparicio. 1997. Behav. Ecol. Sociobiol. 41:129–137.—Lesser Kestrels are a nidicolous species whose clutch size varies between 2 and 6 eggs, but which averages about 4.5. Lesser Kestrels produce about 2 fledglings per nest attempt. There have been several hypotheses put forth to explain the production of surplus eggs and offspring, like that which occurs in Lesser Kestrels. These include the (1) bet-hedging hypothesis which poses that parents living in an unpredictable environment lay large clutches to maximize their reproductive success in good-food years, (2) ice-box hypothesis which suggests that surplus eggs and/or offspring serve as a food supply for the older nestlings during poor-food years, (3) progeny-choice hypothesis which states that parents produce extra offspring and then kill or abandon those with the lowest fitness, and (4) insurance egg hypothesis which postulates that although parents can predict future feeding conditions for raising offspring, one or more surplus eggs can serve as insurance in case of the failure of any egg. Through the manipulation of Lesser Kestrel broods by adding one chick when an egg failed to hatch or eliminating one when the entire clutch had hatched, Aparicio set out to test which of the above hypotheses best explains the production of surplus young in this species. Redundant chicks were costly both in terms of offspring and adult survival. Parents which attempted to raise as many chicks as there were eggs in the clutch were significantly less successful than parents whose brood sizes were reduced by one at hatching. Redundant-chick parents produced fewer offspring of lower quality and with a reduced chance of survival than reduced-chick parents, even when annual food availability was controlled for. Moreover, adult survival of redundant-chick pairs was significantly lower than that of adults in reduced-chick pairs. These data support only the insurance-egg hypothesis (see above), although parents could suffer reproductive setbacks when all of the eggs hatch. [Museo Nacional de Ciencias Naturales (CSIC), J. Gutiérrez Abascal 2, E-28006 Madrid, Spain; e-mail: mcnam3e@fresno.csic.es]—Danny J. Ingoid.

17. Monk Parakeet *Myiopsitta monachus* breeding in southwest France. [Conures veuves *Myiopsitta monachus* nidificatrices dans le Sud-Ouest de la France.] C. Adde. 1998. Alauda 66:66–67. (French).—They may take over the world if we let them! They may be a pretty green parrot and interesting novelty at feeders, but they are also serious agricultural pests in their native Argentina—and becoming established wherever they've been introduced via the pet trade. Now they have nested in southwest France: a typical, bulky twig nest on a beam under the eaves of a dwelling. [Quartier Le More, F 40160 Parentis-en-Born, France].—Jerome A. Jackson.

18. Experimentally reduced paternity affects paternal effort and reproductive success in Pied Flycatchers. J. T. Lifjeld, T. Slagsvold, and H. Ellegren. 1998. Anim. Behav. 55:319–329.—The authors removed 27 monogamously paired male Pied Flycatchers (*Ficedula hypoleuca*) from their nest at various stages, and for variable periods of time during their mate's fertile period, to determine if parental effort is affected by reduced paternity in this species. Extra-pair paternity, as evidenced by genetic markers, was higher in nests in which males were detained (67% of nests) than is normally found (15–17% of nests) for this study population. Male Pied Flycatchers reduced their parental effort with reduced paternity. There were positive relationships between paternity and male parental effort (mean percentage of male feeds to the brood over the observation period), and between paternity and reproductive success (nestling body mass, tarsus length, brood size). The authors caution that these data may not apply to non-experimental conditions. [Zoological Museum, Univ. of Oslo, Sars gate 1, N-0562 Oslo, Norway; e-mail: j.t.lifjeld@toyen.uio.no.]—Jeffrey P. Duguay.

MIGRATION, ORIENTATION, AND HOMING

(see also 36)

19. Clues to the migratory routes of the eastern flyway of the western Palearctics—ringing recoveries at Eilat, Israel [II—Falconiformes]. R. Yosef. 1998. Vogelwarte 39:203–208.—At the north end of the Red Sea, Eilat is a known concentration point of migratory raptors. Of 3224 birds banded, only 32 birds of 6 species were recovered elsewhere. The most commonly recovered species was the Steppe Buzzard (*Buteo buteo*) with 19 recoveries from 1829 birds banded. The Levant Sparrowhawk (*Accipiter brevipes*) was the second most

common with 6 recoveries of 764 banded birds. Most of the recoveries were from the breeding grounds in eastern Europe and Russia, but a few recoveries were from the wintering grounds in Africa. The longest interval between banding and recovery was 12 years and 2 months for a Steppe Buzzard. Although these data indicate the breeding and wintering locations of raptors transiting at Eilat, more data are needed to substantiate these findings. [International Birdwatching Center, P.O. Box 774, Eilat 88106, Israel.]—Robert C. Beason.

20. Migratory fueling in Blackcaps (*Sylvia atricapilla*) under perceived risk of predation. T. Fransson and T. P. Weber. 1997. Behav. Ecol. Sociobiol. 41:75–80.—Body mass in birds, both in terms of the amount of weight gained and how long that mass is maintained, has traditionally been viewed as a tradeoff between the risks of predation and starvation. In migratory birds, the response to predation risk could vary if the level of risk fluctuates between foraging and non-foraging periods. In any case, details regarding how small passerines behave in terms of weight gain and fuel departure load at migratory stopover sights with a high predation risk are lacking. In this study, Fransson and Weber examined the behavior of Blackcaps exposed to a high predation risk at a simulated stopover sight in the laboratory. Initially (during the first two days) Blackcaps exposed to a stuffed Sparrowhawk (*Accipiter nisus*) significantly increased their food intake and fat deposition rate. The average night activity in the Sparrowhawk group increased significantly after the first two nights (more so than both the control group and those exposed to a plastic bottle e.g., disturbance group), indicating their intention to leave earlier with a slightly lower departure load. Since the birds in this study had nowhere to hide during non-foraging bouts, they may have perceived the risk of predation to be equally high during both periods. The authors pose that in such instances, the birds have nothing to loose by increasing their foraging time. Thus, these data support the notion that birds are able to adjust stopover foraging behavior to the level of predation risk. [Sweden Museum of Natural History, Bird Ringing Centre, Box 50 007, S-104 05, Stockholm, Sweden; e-mail: rc-thord@nrm.se]—Danny J. Ingold.

HABITAT USE AND TERRITORIALITY

(see also 7, 8, 10, 24, 26, 27, 28, 29, 35)

21. Habitat partitioning among sympatric wintering Common Eiders *Somateria mollissima* and King Eiders *Somateria spectabilis*. J. O. Bustnes and O. J. Lonne. 1997. Ibis 139: 549–554.—King and Common eiders wintering in coastal Norway segregate by species based on water depth and characteristics of the sea bottom. Common Eiders usually feed in water 0–10 m deep, with an average feeding depth of 7.4 m. By contrast, King Eiders feed in water over 10 m deep, with an average feeding depth of 20.4 m. Common Eiders fed in kelp forests, over sand/rock substrates, urchin barrens, and coralline algal substrates, always avoiding deep water cobble substrate. King Eiders avoided sand/rock substrate and urchin barrens, preferring deep water cobble, kelp forests and coralline algae. Timing during the season was a factor that influenced substrate preference, and both species had different substrate preferences at different times. Segregation prevailed throughout the winter while the ducks were feeding, with water depth a more important segregating factor than substrate type. King Eiders are smaller and less buoyant, which makes them better adapted energetically for deep diving than the larger Common Eiders. Segregation in wintering eider populations virtually eliminates competition between the two species, suggesting that the evolution of these species was heavily influenced by competition for food. Sample sizes were adequate, and results are well-illustrated in a series of figures. [Foundation for Native Research and Cultural Heritage Research, Dept. of Arctic Ecology, Storgata 25, N-9005 Tromso, Norway]—Andy Johnson.

22. Territory size in the Lincoln's Sparrow (*Melospiza lincolnii*). E. Wortman-Wunder. 1997. Southwest. Nat. 42(4):446–453.—The author studied the territory size and relationships of the Lincoln's Sparrow in Garfield Co., Colorado during June and July 1995. Detailed measurements were made of 29 territories at two sites within Fourmile Park along the Fourmile Creek (elevation 2600 m). The population density was low with 0.5 to 1.4 Lincoln's Sparrow pairs per hectare. Vegetation analyses indicated that both sites had a similar composition of dense willows, open scattered shrubs and grasses. Vegetation composition did not

vary with sparrow territory size or placement of territory, even though peripheral territories were larger than central ones. The amount of time Lincoln's Sparrows spent defending resources and protecting their nests was not correlated with territory size. Observations suggest that competition for space was minimal in the study areas. [Dept. of Biology, EPO, Univ. Colorado, Boulder, CO 80303, USA.]—Tom Leiden.

23. No relationship between territory size and the risk of cuckoldry. M. Rodrigues. 1998. Anim. Behav. 55:915–923.—It has been suggested that males with larger territories are less likely to be cuckolded than males with smaller territories. Therefore, territory size should be larger during the fertile period of the female and smaller after egg laying. Male territory size for the Chiffchaff (*Phylloscopus collybita*) was estimated during the pre-fertile, fertile, and post-fertile periods of the breeding season. During each of the breeding stages, three 15 min periods were spent in each male's territory to determine home range size. Male territory size decreased from the pre-fertile to the fertile period. It is suggested that a larger territory may keep a resident male further from his mate and thus facilitate male intrusion and extra-pair copulations. Rodrigues points to the need for an operational definition of territoriality. [A/C V. Arruda, Departamento do Ecologia e Zoologia, Universidade Federal de Santa Cartina, 88040-900 Florianopolis-SC, Brazil; e-mail: drigues@cob.ufsc.br.]—Jeffrey P. Duguay.

ECOLOGY

(see also 4, 16, 17, 21, 22, 26, 27, 28, 29, 30, 33, 35, 37)

24. Breeding bird communities of the Carinthian Krappfeld: habitat preferences, bird community structure, and management. [Die Vogelwelt des Krappfeldes in Karnten: Brutzeitliche Habitatpraferenzen, Strukturbeziehungen und Managementvorschlage.] R. Lentner. 1997. Egretta 40:85–128. (German, English summary)—Line transects were used to census study areas in the Krappfeld, Austria. During 1994, 96 species of birds were recorded, 55 of which were breeding. This is higher than predicted based on the species area curves for central Europe. Blackcap (*Sylvia atricapilla*) and Yellowhammer (*Emberiza citrinella*) were the most common and widespread species. The relatively high density (1 pair per 6–7.5 ha) of Red-backed Shrike (*Lanius collurio*) indicates that the area contained good habitat for that species. Skylarks characterized the open farmland, the most common habitat type. Fields adjacent to woodlots had more breeding species (mean = 17) than fields without woodlots (mean = 4). Quail (*Coturnix coturnix*) and Whinchat (*Saxicola rubetra*) characterized fallow fields. Forest edges had the greatest number of avian species and numbers. Coal Tit (*Parus ater*), Woodpigeon (*Columba palumbus*) and Dunnock (*Prunella modularis*) were characteristic species. Wetlands and riparian habitat were characterized by Savi's Warbler (*Locustella luscinoides*), Marsh Warbler (*Acrocephalus palustris*) and Reed Bunting (*Emberiza choeniclus*). Partridge (*Perdix perdix*) and Quail were mutually exclusive in their occurrence. Partridge were found in hedges and small woodlots and Quail in corn fields. The Yellowhammer was the best indicator species of extensively tilled agricultural land. [Inst. fur Zoologie der Universitat Innsbruck, Technikerstrasse 25, A-6020 Innsbruck, Austria.]—Robert C. Beason.

25. The importance of spatial scales in long-term monitoring of colonial Charadriiformes in southern France. N. Sadoul. 1997. Colon. Waterbirds 20:330–338.—Nine species of colonially nesting Charadriiformes have been monitored for 40 years in 3 ecologically distinct localities in the Camargue region. The author discusses the data in the context of 3 spatial scales: region, locality, and colony. At the regional scale Avocets (*Recurvirostra avosetta*) and Common Terns (*Sterna hirundo*) have declined in numbers, while Gull-billed Terns (*S. nilotica*), Little Terns (*S. albifrons*) and Black-headed Gulls (*Larus ridibundus*) have remained substantially the same, and Yellow-legged Gulls (*L. cachinnans*), Slender-billed Gulls (*L. genei*), Mediterranean Gulls (*L. melanocephalus*), and Sandwich Terns (*Sterna sandvicensis*) have increased exponentially. The author used the Leslie Matrix Model to simulate population trends in the latter 4 species and concluded that immigration rather than local recruitment is the major cause of the exponential growth. In the case of the Slender-billed Gull the increase throughout the western Mediterranean may reflect emigration from the Black Sea and suggests conservation problems on a very large spacial scale. In comparing regional and local scales the author uses examples of the Yellow-legged Gull, in which the population

increase is similar in the region and all 3 localities (explained by immigration and local recruitment), and the smaller species in which trends in the localities differ (explained by local constraints), thus suggesting further analysis at the colony level. As an example of colony dynamics, the increase in area of a commercial salt producing locality led to increases in breeding sites from 1953–1973 for the smaller Charadriiformes, but the trend was reversed when the landscape stabilized, and breeding sites eroded and resulted in competition with Yellow-legged Gulls for stable nesting localities. Hence the smaller species decreased in abundance and the larger prospered as result of local stability. The author concludes that changes in bird numbers are not always a measure of population health, and that breeding success may be a better indicator of environmental conditions. Further, immigration may obscure local conservation problems. However, comparisons of trends at different spacial scales and among species increase the usefulness of census data. This is a complex but interesting paper. [Station Biologique de la Tour du Valat, Le Sambuc, 13200 Arles, France.]—William E. Davis, Jr.

POPULATION DYNAMICS

(see also 14, 22, 24, 25, 32, 33, 37)

26. Long-term monitoring and conservation of herons in France and Italy. H. Hafner and M. Fasola. 1997. Colon. Waterbirds 20:298–305.—Internationally important populations of herons and egrets use the wetlands of southern France and Northern Italy, including freshwater marshes and ricefields (Italy) and brackish and saltwater lagoons. Monitoring of breeding and wintering populations has been conducted in Italy for 21 years and in France for 29. In this paper the authors review the information collected and assess the current understanding of population regulation, vulnerability factors, and conservation priorities in the context of spacial and temporal scales. They report on the population dynamics of resident Cattle Egrets (*Bubulcus ibis*), short-distant migrant Little Egrets (*Egretta garzetta*), and long-distance migrant Purple Herons (*Ardea purpurea*). Winter weather was the main population control factor for Cattle and Little Egrets, and hydrological conditions in the African wintering grounds had a significant effect on Purple Heron populations. The authors conclude that 25 years is the minimum time-scale for assessing the effects of climatic perturbations, but that aspects of breeding biology may be assessed in 10 years or less. The appropriate spacial-scale depends on the questions asked, e.g., small-scale for questions of breeding parameters to large-scale for questions including wintering grounds. Long-term studies make possible evaluation of conservation initiatives, identification of vulnerability factors, and establishment of conservation priorities. Breeding colony site protection has been the main conservation strategy historically, but current threats involve foraging habitat, e.g., changing rice cultivation practices and managing marshes for hunting, grazing, and reed harvesting. The authors conclude that future conservation and research programs should include these issues. [Station Biologique de la Tour du Valat, le Sambuc, F-13200 Arles, France.]—William E. Davis, Jr.

27. Long-term studies and conservation of Greater Flamingos in the Camargue and Mediterranean. A. R. Johnson. 1997. Colon. Waterbirds 20:306–315.—In this paper the author discusses the spacial and temporal scales for the study and conservation of the Greater Flamingo (*Phoenicopterus ruber*), a species in which individuals may live 30 years or more. In the Camargue delta, where water levels have long been managed for salt production, numbers of breeding pairs and chicks have been monitored since 1947. Unpredictable disturbances, such as harsh winters may cause significant adult mortality, and strong winds, heavy rains or unique events may strongly affect breeding success—in 1987 a child's balloon caused a breeding-colony panic resulting in the loss of 3000–4000 eggs and chicks. Erosion of colony sites, disturbance by airplanes, and predation by gulls led to the cessation of breeding in 1963, but conservation measures led to resumption of breeding in 1969 and a breeding island was subsequently built. The flamingos colony grew to 20,000 pairs by 1986, with >50,000 flamingos present in southern France in some years. The author suggests that saturation of the Camargue colony has led to the colonization of other areas in the western Mediterranean, and emphasizes the need for active management of flamingo colonies. Flamingos are opportunists, with some birds sedentary and others migratory. More than 220,000 recoveries and resightings of Camargue-banded birds suggests that most stay within the western Mediterranean basin. Flamingos regularly feed in rice-paddies and may eat rice as well

as invertebrates. During nesting, most Camargue birds forage within 10 km of the colony, but may forage up to 70 km away. Elsewhere, they may be forced by drying conditions to forage as far as 180 km from colonies, emphasizing the need to conserve even distant foraging locations. The irregular episodes of high mortality among these long-lived birds, and their varied dispersal pattern, necessitate long time-scale and large spacial-scale studies in order to gain an understanding of their population dynamics. [Station Biologique de la Tour du Valat, Le Sambuc, 13200 Arles, France.]—William E. Davis, Jr.

28. Philopatry and nomadism: contrasting long-term movement behavior and population dynamics of White Ibises and Wood Storks. P. C. Frederick and J. C. Ogden. 1997. Colon. Waterbirds 20:316–323.—In this paper the authors compare and contrast the breeding strategies and movements of White Ibises (*Eudocimus albus*) and Wood Storks (*Mycteria americana*)—species with similar ranges in the southeastern U.S., that breed and forage in dynamic wetlands which produce food resources that are highly unpredictable in time and location. White Ibis population estimates from 1930–1992 suggest fluctuations from 51,000 to 169,000 breeding pairs with severe decreases between 1976–1992. An overall decrease of 90% in the Everglades region of Florida was concomitant with an expansion of the breeding range into 5 states. Wood Storks have declined in numbers by about 50% from early century estimates of 15,000–25,000 pairs, and experienced a range expansion into northern Florida, Georgia and South Carolina, with a substantial collapse in the south Florida breeding population. White Ibises show weak philopatry, and tend to quickly abandon colonies and establish new ones in response to degraded breeding conditions. Wood Storks show strong philopatry, even during suboptimal conditions, and change colony locations gradually. Hence the longevity of stork colonies is greater. The authors suggest that these contrasting styles are related to differences in foraging strategies, with ibises relying largely on invertebrate prey associated with shallow, short hydro-period wetlands, while storks eat large fish associated with more permanent wetlands. In addition, storks have a larger foraging range than ibises. The authors suggest that conservation strategies for the 2 species should be different with an emphasis on preserving a network of short-hydroperiod wetlands for White Ibises, and the preservation of colony sites and a mosaic of surrounding wetlands for Wood Storks. Although many of the historical movements of both species can be traced to anthropogenic factors, natural disasters have also been implicated. The authors conclude that the well being of both species at the scale of decades or centuries would require preservation of a variety of wetlands ecosystems at a landscape scale. [Dept. of Wildlife Ecology and Conservation, P.O. Box 110430, Univ. of Florida, Gainesville, FL 32611-0430 USA; email: pcf@gnv.ifas.ufl.edu.]—William E. Davis, Jr.

29. Population dynamics and conservation of Snail Kites in Florida: the importance of spacial and temporal scale. R. E. Bennetts and W. M. Kitchens. 1997. Colon. Waterbirds 20: 324–329.—Data from 271 radio-tagged Snail Kites (*Rostrhamus sociabilis*) suggest that in Florida Snail Kites constitute a single nomadic population in which birds often move throughout their range through a network of local habitats. The authors suggest that the population is limited by drought since the kite's food, Florida apple snails (*Pomacea paludosa*), is aquatic and has limited resistance to drought. Droughts occur periodically, but because local rainfall patterns are variable, local drying out of wetlands occurs with high frequency, while simultaneous drying throughout the Snail Kite's range is rare. The response of Snail Kites to local drought is simply to move to a new location. The authors argue that current conservation efforts are flawed. Keeping small wetlands flooded during drought may be counterproductive because prolonged flooding may damage vegetation critical to kite foraging and nesting habitat. Currently designated critical habitat is mostly in the Lake Okeechobee and Everglades watersheds that are in close proximity and often dry simultaneously. Hence they argue that conservation efforts should be at the regional level with protection of wetlands in other watersheds where drying may be asynchronous and thus provide drought refugia. [Dept. of Wildlife Ecology and Conservation, Florida Cooperative Fish & Wildlife Research Unit, Univ. of Florida, Gainesville, FL 32611-0450 USA; email: bennetts@theonramp.net.]—William E. Davis, Jr.

30. Estimating the size of Little Grebe (*Tachybaptus ruficollis*) breeding populations. R. Gutierrez and J. Figuerola. 1997. Ardeola 44:157–161.—The breeding population of Little

Grebes was censused at the Llobregar Delta near Barcelona in northeastern Spain during April–May 1994. Because of their secretive behavior, small grebes are often difficult to census, thus the authors compared two techniques: (1) call counts and (2) systematic nest searches. Censuses were conducted by two equally experienced groups in the same area on the same or following day. Estimates based on calls were 19% below those based on nest searches, with the number of pairs underestimated at 9 of 24 sites and overestimated at only one site. Ten of 76 pairs observed nested in reeds (Phragmites) or cattails (Typha) in the center of ponds; 66 nested in reeds along the edges. Most pairs not detected by calls nested in the cattails. [Reserves Naturals Delta del Llobregar, Department d'Agricultura, Ramaderia i Pesca, Gran Via de les Corts Catalanes, 612-614, 2n. E-08007 Barcelona, Spain.]—Jerome A. Jackson.

ZOOGEOGRAPHY AND DISTRIBUTION

(see also 17, 19, 27, 28, 29)

SYSTEMATICS AND PALEONTOLOGY

31. Essentialistic and evolutionary thinking in the field of systematic ornithology during the 19th and 20th centuries. J. Haffer. 1997. J. fur Ornithogie 138:61–72. (German, English summary).—Haffer traces the pattern and process of the way we classify birds at the species level from the late 18th century through the late 20th century, identifying two major schools of thought that he refers to as "essentialistic microtaxonomy" and "evolutionary microtaxonomy." He traces the intellectual lineage of these schools both in Europe and in North America, noting the origins of essentialistic (typological) classification with Buffon and Linnaeus and a sharp transition to evolutionary classification beginning in the late 19th century—a result of the development of concepts associated with Darwinian evolution. Beginning with the Wilson (Alexander Wilson, 1766–1813) School in North America, and the Pallas (Peter Simon Pallas, 1741–1811)-Schlegel (Hermann Schlegel, 1804–1884) School in Europe, Haffer leads us through the development of early typological species and subspecies concepts. He refers to the evolutionary microtaxonomy school in North America as the Baird (Spencer Fullerton Baird)-Coues (Elliott Coues,) school. In a graphic "phylogeny" (p. 63) of essentialistic and evolutionary microtaxonomists, Haffer shows separate European and North American lineages of essentialistic practitioners, but converging lineages of evolutionary microtaxonomists with Ernst Mayr and his biological species concept as the clear "keystone" bridging North American and European schools. From this convergence, however, Haffer forsees a split into two new schools supporting different species concepts: one with wide species limits resulting in relatively few polytypic species, and the other with narrow species limits resulting in numerous monotypic species.

Haffer gives us an important historical perspective on the way we view bird species. Since this article was published we have seen further development of his predicted split. Unfortunately many developments and major contributions which have shaped systematics in the past thirty years (e.g., numerical taxonomy; the work of Charles Sibley) are not discussed. But this is a brief review, laying the foundation for a more in depth analysis. Although Darwinian evolution provided opportunity for a major paradigm shift, I would argue that the development of modern computers and molecular systematics have been tools that have facilitated an even greater, more abrupt turning point. [Tommesweg 60, D-45149 Essen, Germany].—Jerome A. Jackson.

EVOLUTION AND GENETICS

(see also 16, 18, 31)

32. Population genetics and the spatial scale of conservation of colonial waterbirds. V. L. Friesen. 1997. Colon. Waterbirds 20:353–368.—The author suggests that conservation of waterbirds is more effective at the population level than at the colony level. The spatial scale of populations can be determined either by direct observation (e.g., demographics such as dispersal rates or reproductive success) or by molecular genetics studies. Establishing this spatial scale facilitates determination of several important conservation factors: (1) estimating gene flow (important in predicting whether birds are likely to naturally recolonize areas where they have been extirpated by natural or anthropogenic factors), (2) assessing the

impact of mortality events on genetic diversity, (3) identification of "source" and "sink" populations, (4) appropriateness of captive breeding and translocation efforts, (5) establishing uniqueness (genetic distinctiveness) for setting conservation priorities (e.g., discovering "cryptic" species), and (6) determining effective population size (the number of individuals that actually contribute to the gene pool). The author presents a discussion of a variety of molecular genetics techniques (e.g., allozyme electrophoresis, mitochondrial DNA, variable number tandem repeats, randomly amplified polymorphic DNAs) including their strengths and weaknesses. Case studies of murres, murrelets, and guillemots highlight the effectiveness of several of these techniques. For example, Thick-billed Murres (*Uria lomvia*) from different colonies in the Atlantic showed no differentiation in allozymes or mtDNA suggesting that they are all part of a single population and that loss of a single colony would not significantly affect the population's genetic resources. However, murres from the Atlantic and Pacific Oceans are highly differentiated and are probably genetically isolated populations. Marbled Murrelets (*Brachyramphus mamoratas*) are currently divided into North American (*B. m. marmoratus*) and Asiatic (*B. m. perdix*) subspecies, but cytochrome b and allozyme studies suggest that the North American subspecies is more closely related to Kittlitz's Murrelet (*B. brevirostris*) than to its own Asiatic subspecies, suggesting that both are actually "cryptic" species requiring separate conservation management. Studies of other species suggest that spatial scales of populations vary widely. The author concludes that we have a long way to go before we reach a comprehensive understanding of spatial scales of colonial waterbirds or use this information for conservation purposes. We need more rigorous analyses, larger sample sizes, more comprehensive coverage, and the use of multiple methods. This is a clear, concise, well-written paper that should be of interest to anyone studying colonial waterbirds. [Dept. of Biology, Queen's Univ., Kingston, Ontario K7L 3N6, Canada; email: friesenv@biology.queensu.ca.]—William E. Davis, Jr.

33. Genetic variation and gene flow in populations of Common Starlings (*Sturnus vulgaris*). P. J. de la Cruz-Cardiel, S. J. Peris, B. Deceuninck, and J. A. Elena-Rossello. 1997. Ardeola 44:173–181. (Spanish, English abstract, table, and figure captions).—In the past 60 years, populations of European Starlings in western Europe have grown and expanded into the Iberian peninsula. The rate of expansion onto the Iberian peninsula has been at a rate of about 4.2 km/year. Expansion has been linked to agriculture and the anthropophilic nature of the species. In many areas it associates with the Black Starling (*Sturnus unicolor*) and the birds nest in mixed groups. Birds from three populations on the Iberian peninsula were included in this study: Sudanell, Aranda, and Biarritz. The Sudanell sample included 18 breeding birds; the Aranda sample included 15 wintering birds; the third sample, 15 breeding birds. Using electrophoresis the authors examined 30 loci from 14 enzyme systems. Heterozygosity (H = 0.090), percentage of polymorphic loci (P = 26.6%), and average number of alleles per locus (A = 1.27) were similar to values found in other birds. Interpopulation genetic diversity was about 3.9%. High gene flow was evident among populations and the samples were considered to be from the same gene pool. [Departamento de Biologia Vegetal, Facultad de Biologia, Universidad de Salamanca, 37007 Salamanca, Spain.]—Jerome A. Jackson.

PHYSIOLOGY AND DEVELOPMENT

(see also 8, 34)

PLUMAGES AND MOLT

(see also 5)

34. Molt of Northern Shovelers wintering in South Texas. W. D. Tietje and J. K. Vreeland. 1997 Southwest. Nat. 42:454–459.—Molting requires large amounts of energy, comparable to that required for reproduction. Environmental factors can be critical to the molting process. The authors studied several molting parameters of the Northern Shoveler (*Anas clypeate*) during a winter of normal temperatures and low rainfall (1982–1983), and a winter of record low temperatures and high rainfall (1983–1984). Two diverse areas were selected along the Gulf Coastal Zone of Texas: one freshwater wetland, the other a saltwater wetland. Over 400 shovelers were collected and the molt intensity (e.g., mean count of emerging

feathers) was analyzed against age, sex and body weight. Shoveler molt intensity was greater during the year of higher rainfall (1983–1984) which is consistent with previous reports. Adult and juvenile males achieved peak molt intensity in February, one month earlier than adult and juvenile females. Only in juvenile males was there a correlation between molt intensity and body condition. The authors did not find any differences in molt intensity between the fresh- and saltwater habitats, even though freshwater wetlands provide a greater diversity and abundance of food items compared to saltwater wetlands. [Wildlife and Fisheries Sciences Dept., Texas A & M Univ., College Station, TX 77840, USA.]—Tom Leiden.

WILDLIFE MANAGEMENT AND ENVIRONMENTAL QUALITY

(see also 8, 24, 25, 26, 27, 28, 29)

35. Effect of firewood harvesting on birds in a California oak-pine woodland. P. A. Aigner, W. M. Block and M. L. Morrison. 1998. J. Wildl. Manage. 62:485–496.—This study examined the response of breeding bird communities to experimental firewood harvest in an oak-pine woodland. The study occurred in the foothills of northern Sierra Nevada, California, and consisted of a total of 60 3.1-ha study plots. In 30 treatment plots, 23% of the total tree basal area was removed; old growth trees or trees with nest cavities were preserved. Thirty control plots had no such treatment applied. The authors censused the bird communities one year prior to the treatment and 2 years post-treatment. A total of 99 species were recorded in this study, and treatment effects were species-specific and often varied among years. Population trends for 14 species were affected by the harvesting. Ten species showed increased populations, 2 had decreased populations, and 2 had varying population changes. Six of the 10 species which responded positively to harvesting used brush piles regularly. This study suggests that small-scale firewood harvests of the magnitude used in this study had little negative impact on the bird community in the short term (2 years). However, the authors caution that they used a conservative harvest and small areas were harvested. Additionally, the effects on uncommon species may have gone undetected and the authors note that factors such as site fidelity may influence responses over the long term. [Dept. of Environmental Science, Policy, and Management, University of California at Berkeley, Berkeley, CA 94720, USA, and School of Forestry, Northern Arizona University, Flagstaff, AZ 86011, USA].—Kerri T. Vierling.

36. Bird flight characteristics near wind turbines in Minnesota. R. G. Osborn, C. D. Dieter, K. F. Higgins, and R. E. Usgaard 1998. Am. Midl. Nat. 139:29–38.—As interest increases in the use of wind energy as an alternative energy source, so does awareness of bird mortality caused by wind turbines. Research has focused on finding ways to decrease avian mortality through design changes as well as through the placement of turbines vis-à-vis breeding, wintering or migrating birds. The authors monitored the abundance and behavior of birds for twenty months at the Buffalo Ridge Wind Resource Area in Minnesota. Seventy species were recorded at the site, of which 39 were considered resident. Red-winged Blackbirds (*Agelaius phoeniceus*), Common Grackles (*Quiscalus quiscula*) and Mallards (*Anas platyrhynchos*) were the most abundant species, while raptors constituted only 4% of the birds surveyed. Two aspects of flight patterns were studied: how close birds flew to the towers and how high off of the ground they flew. Waterfowl and raptors flew the closest to the towers, but migrating waterfowl flew at heights well above the turbines. The only instance of mortality reported by plant workers, and not verified by the authors, was that of a Ruddy Duck (*Oxyura jamaicensis*). The low percentage of raptors and the tubular design of the towers possibly prevented further avian mortality. The American Kestrel (*Falco sparverius*) was considered to be most at risk since it flew at heights that were within the blade-swept area. Passerines generally flew at heights well below the blade height, and were thus not at much risk of colliding. The authors concluded that the Buffalo Ridge Wind Resource Area is not a major threat to resident or migratory birds. [Dept. Wildlife and Fisheries Sciences, South Dakota State Univ., Brookings, SD 57007, USA.]—Tom Leiden.

37. European woodpeckers and anthropogenic habitat change: a review. G. Mikusinski and P. Angelstam. 1997. Die Vogelwelt 118:277–283.—Mikusinski and Angelstam review European woodpecker population trends from 1970–1990 as reflected in data from the Euro-

pean Bird Database. For their analysis they divide species into three groups: omnivores, anteaters, and forest insectivores. Of ten European species, none shows an overall increase; six are declining. Woodpecker diversity remains greatest at high altitudes and in economically less developed areas of eastern Europe. To understand population changes, the authors argue that we need to be looking at populations at local, landscape, and continental levels.

Within Europe, woodpecker diversity decreases to the north and southeast as a result of treeless tundra and steppe biomes. Human-induced deforestation associated with human population growth and agricultural development in central and western Europe have resulted in large areas with few or no woodpeckers and patches of high altitude forest (areas unsuitable for agriculture; Catabrian Mountains, Pyrenees, montane southern Germany, lower Alps, Carpathian and Scandinavian mountains) with high woodpecker diversity. These montane forest habitats have had greater spatial and temporal contiguity than remaining forest habitats of adjacent lowlands. Also importantly, the montane forests have retained more of their natural forest dynamics as a result of less intensive forestry practices—less even-age management, greater tree species diversity. The Bialowieza Forest of Poland is cited as an example of a lowland forest of eastern Europe that retains high woodpecker diversity as a result of less-intensive forestry and protection of the forest as a hunting preserve.

Among European Woodpeckers, the omnivorous Great Spotted Woodpecker (*Dendrocopos major*) is the greatest habitat generalist and seems to have the most stable population. The Syrian Woodpecker (*Picoides syriacus*) is similarly generalized and stable, showing range increases in central Europe. The ant-eating Black Woodpecker (*Dryocopus martius*), because of its size and forest interior habitats, is more affected by forest losses than other anteaters (Green Woodpecker, *Picus viridis*; Grey-headed Woodpecker, *Picus canus*; Wryneck, *Jynx torquilla*) which can use forest edge or even open areas. However, the latter species are being negatively affected by a number of human activities that are reducing ant populations and by decreased availability of suitable nesting sites. Forest insectivores that depend on deciduous trees (Middle-spotted Woodpecker, *Picoides medius*; Lesser Spotted Woodpecker, *P. minor*; White-backed Woodpecker, *P. leucotos*) are declining rapidly as a result of deciduous forest losses. The Three-toed Woodpecker (*P. tridactylus*) has had local increases, but is generally restricted to high altitude or boreal conifers and showing signs of decline as a result of intensification of forestry practices. [Grimso Wildlife Research Station, Dept. of Conservation Biology, Swedish Univ. of Agricultural Sciences, S-730 91 Riddarhyttan, Sweden.]—Jerome A. Jackson.