

## RECENT LITERATURE

Edited by Danny J. Ingold

### RESEARCH TECHNIQUES

(see also 34, 47)

1. **Estimating survival of song bird carcasses in crops and woodlots.** G. M. Linz, D. L. Bergman, and W. J. Bleier. 1997. *Prairie Nat.* 29:7–13.—Managers determine the success of avian damage control efforts, and the extent of nontarget species losses, by counting carcasses in treated areas. However, because scavengers consume some of the carcasses before they can be counted, the extent of carcass loss must be estimated in order to arrive at an accurate estimate of deaths. The authors placed songbird carcasses in sunflower and corn fields, and in nearby woodlots, and checked the carcasses each day for four days. Rate of carcass removal varied significantly among the three habitats, with only 58% of carcasses in sunflower fields still intact after one day, 82% in corn fields, and 90% in woodlots. The authors point out that carcass loss to scavengers varies with habitat and season, precluding the option of applying the same estimate of carcass loss in all situations. Instead, an index of loss must be determined for each situation by placing a known number of marked carcasses in the area just prior to treatment. The authors also note that the rapid loss of carcasses demands that they be counted within a day of application of lethal agents. [National Wildlife Research Center, Great Plains Field Station, 2301 Univ. Drive, Bldg. 23B, Bismarck, ND 58504, USA]—Scott W. Gillihan.

2. **Validating the use of artificial nests in predation experiments.** C. P. Ortega, J. C. Ortega, C. A. Rapp, and S. A. Backensto. 1998. *J. Wildl. Manage.* 62:925–932.—The use of artificial nests is becoming more widespread as a way to approximate predation in natural nests. However, the assumption that predators respond to artificial nests the way they would to natural nests has not been tested. The authors examined differences in predator response to quail eggs in three treatments: 1) American Robin nests (*Turdus migratorius*) in their original locations, 2) artificial wicker-basket nests in a natural pattern 30 m in a random direction from the natural nest, and 3) artificial nests placed in a 6 × 8 grid pattern at 30 m intervals. In addition, the authors examined the effect of nest height on predation rates. Nests were checked at 5-day intervals for the 15-day trial. Natural nests were depredated more frequently (44%) in the first 5-day interval compared to artificial nests 30 m from the natural nest (11%), and artificial nests in the 30 m grid (14.6%). At the 10 day check, all treatments had undergone similar predation rates (44.4–66.7%). However, by the end of the 15 day trial, 91.7% of the artificial nests in the 30 m grid were depredated compared to a 70.4% predation rate of the natural robin nests, and 66.7% predation rate of the artificial nests 30 m from the robin nest. The authors found no significant differences in predation rates between nests placed ≤2 m and those >2 m aboveground. In this study, the authors note that predation of artificial nests most closely approximated predation of natural nests at the 10-day visit. In addition, the authors suggest that results from artificial nest studies be used with caution because predators seem to respond differently to natural and artificial nests. [Dept. of Biology, Fort Lewis College, Durango, CO 81301 USA; e-mail: ortega\_c@fortlewis.edu.]—Kerri T. Vierling.

3. **Effects of human disturbance on success of artificial duck nests.** R. Olson and F. C. Rohwer. 1998. *J. Wildl. Manage.* 62:1142–1146.—The impact of human disturbance on nest success may vary with species and habitat. During 1993 and 1994, the authors examined how various disturbances affected predation on artificial duck nests. Disturbances included a single human visit to nests, duck feces on eggs, and partial damage to eggs from nest-searching or mishandling of eggs. Additionally, the authors examined the relationships of habitat type (wetland edge, dense nesting cover, and roadside right-of-way) with the various disturbances. The effect of a single human visit to artificial nests was equivocal. In wetland edges and roadside right-of-ways, nests with trails experienced higher predation than nests without trails in one of two years. However, the presence of a human trail did not influence predation rates on artificial nests in dense cover during both years. The presence of duck feces and damaged eggs in artificial nests significantly influenced predation rates. Predation was higher in these treatments than in control nests with no duck feces and no broken eggs, presumably

because the feces and broken eggs increased the ability of mammalian predators to find nests. The authors suggest that waterfowl researchers clean eggs when ducks defecate after disturbance. Additionally, they suggest that investigators remove investigator-damaged eggs. Finally, the results of the trails were equivocal, and the authors encourage more research examining human visitation and responses by predators to specific cues. [Natural Resources Institute, Univ. of Manitoba, Winnipeg, MB R3T2MB, Canada.]—Kerri T. Vierling.

## BEHAVIOR

(see also 11, 12, 17, 18, 20, 31, 34, 36, 37, 47)

4. **The use of landmarks in three species of food-storing corvids.** K. L. Gould-Beierle and A. C. Kamil. 1998. *Ethology* 104:361–377.—Clark's Nutcrackers (*Nucifraga columbiana*), Pinyon Jays (*Gymnorhinus cyanocephalus*), and Western Scrub Jays (*Aphelocoma coerulescens*) differ considerably in their dependence on stored food caches. Because of this, it is hypothesized that these species might differ in the extent to which natural selection has favored the use of landmarks as locational cues. This study was aimed at testing for interspecific differences in response to changes in experimentally manipulated landmarks. The basic protocol was to train birds to find hidden food items, alter the location of landmarks, and evaluate the searching behavior of the test subjects. Three experiments were conducted: one in which a plastic landmark was displaced either parallel or perpendicular to a metal tray, another in which the landmark was removed and the location of the tray was altered, and a third in which the location of the tray was continuously altered between trials (global cues unreliable). All three species displaced their search efforts relative to parallel and perpendicular displacements of the plastic landmarks and similarly shifted their search efforts relative to displacement of the tray. There were no differences among species in the relative responses to these manipulations suggesting that the species are similar in their dependence on landmarks as locational cues. [Kristy L. Gould-Beierle, Dept. of Psychology, Cornell Univ., Ithaca, NY 14867, USA.]—Jeffrey G. Kopachena.

5. **Release factors of breeding activities in Capercaillie (*Tetrao urogallus*) hens.** M. Catusse. 1998. *Ethology* 104:407–420.—In Capercaillies male attendance on leks and display behaviour has been strongly linked to photoperiod. However, the activity of females on these leks, which is much more cryptic and difficult to observe, appears to be less predictable. This study evaluated the extent to which a variety of abiotic factors, male activities, and male-female interactions predicted female activity on a lek. The analyses indicated little effect of the measured abiotic factors on female lek attendance. Hen receptivity seemed to be more correlated with cock territorial activity and in particular, the appearance of hens on the lek was most strongly correlated with the peak of territory stability and sound display among cocks. Reciprocal interactions among hens and cocks appear to reinforce hen receptivity and intensive behavioral interactions among cocks. [Office National de la Chasse, 8 impasse champ fila, 38320 Eybens, France; e-mail: m.catusse@onc.gouv.fr.]—Jeffrey G. Kopachena.

6. **The protector hypothesis: do Black Skimmers find refuge from predators in Gull-billed Tern colonies?** S. M. Pius and P. L. Leberg. 1998. *Ethology* 104:273–284.—It has been suggested that one reason some birds form mixed species colonies is that some species derive protection through the antipredator behavior of other species (protector species). In Louisiana, Black Skimmers (*Rhynchops niger*) can be found in both monospecific colonies or in mixed species colonies with Gull-billed Terns (*Sterna nilotica*). This study evaluated the protector hypothesis among Black Skimmers by measuring responses of birds to natural and simulated predator intrusions. Natural predators consisted of Herring Gulls (*Larus argentatus*), Laughing Gulls (*L. atricilla*), and Ruddy Turnstones (*Arenaria interpres*). Observations showed that, in mixed colonies, Gull-billed Terns reacted more strongly toward these predators than did Black Skimmers. Simulated predators were represented by models of a mink, a gull, and a duck (used as a control). As before, Gull-billed Terns showed much stronger responses to the simulated predators than did the Black Skimmers. These observations suggest that Black Skimmers might incur an antipredator advantage by nesting in association with Gull-billed Terns. [Dept. of Biology, Univ. of Southwestern Louisiana, Lafayette, LA 70504, USA; e-mail: PLL6734@usl.edu.]—Jeffrey G. Kopachena.

7. **Assortative mating in falcons: do big females pair with big males?** P. Olsen, S. Barry,

G. B. Baker, N. Mooney, G. Cam, and A. Cam. 1998. *J. Avian Biol.* 29:197–200.—Breeding pairs of Peregrine Falcons (*Falco peregrinus*), Brown Falcons (*F. berigora*), and Nankeen Kestrels (*F. cenchroides*) were examined for evidence of nonrandom mating with respect to size (here assessed by flattened wing chord). In all three species, wing length was positively correlated between pair members, indicating that pairing was assortative. The relationship was especially strong for Brown Falcons (18 pairs) and kestrels (41 pairs). Positive assortative mating by wing length has not been reported in other raptors (assortative mating by tail length may occur in Merlins [*F. columbarius*]), although assortative mating by age has been documented in several species. The findings of Olsen et al. have implications for the evolution of reversed size dimorphism in raptors, but the selective advantages of assortative mating by size, if any, await further investigation. [Div. of Botany and Zoology, Australian National Univ., Canberra, ACT 0200, Australia; e-mail: penny.olsen@anu.edu.au]—Jeff Marks.

8. **What cues do Brown-headed Cowbirds use to locate Red-winged Blackbird host nests?** E. D. Clotfelter. 1998. *Anim. Behav.* 55:1181–1189.—Brood parasites use both active and passive strategies for locating host nests, but little is known about the specific cues that brood parasites use to locate these nests. Clotfelter examined environmental variables (such as proximity of trees to nests) and behavioral cues (such as aggressive behavior towards mounts) in determining patterns of Brown-headed Cowbird (*Molothrus ater*) parasitism on Red-winged Blackbirds (*Agelaius phoeniceus*) in Wisconsin. Parasitized nests were nearer to trees than were unparasitized nests. Perches, however, were not nearer to parasitized than unparasitized nests. Clotfelter suggests that frequent perch use by blackbirds may have precluded use by cowbirds. No measures of nest conspicuousness were found to influence cowbird parasitism. Red-winged Blackbirds responded aggressively towards cowbird mounts. There were, however, no differences in aggressiveness towards cowbirds by blackbirds of parasitized and unparasitized nests. Parasitized females gave the nest-associated type (chit) song more often than did females whose nests were not parasitized, suggesting that host behavior may be important in determining patterns of brood parasitism. [Dept. of Zoology, Birge Hall, 430 Lincoln Dr., Univ. of Wisconsin, Madison, WI 53706, USA; e-mail: ecltfltr@macc.wisc.edu.]—Jeffery P. Duguay.

9. **Differences in begging behaviour between Barn Swallow, *Hirundo rustica*, nestlings.** A. Lotem. 1998. *Anim. Behav.* 55:809–818.—Recent models predict that nestling begging should increase with the offspring's need. However, factors such as the offspring's past experience, variations in effectiveness and cost of solicitation, and sibling competition may confound this relationship. Lotem manipulated brood size of Barn Swallow nestlings to create differences in their long-term determinants of need (growth rate and body condition) and tested the extent to which begging behavior reflects these differences. There was an increase in begging with both long-term and short-term (time since last feeding) need. However, the relationship between begging and long-term need is not clear. When nestlings grew older, begging levels of small nestlings from large broods decreased. Also, small nestlings from large broods improved their growth rate and body condition, but still begged less than expected. Lotem suggests that if nestlings adjust their costly begging efforts in relation to several factors, then begging will not be correlated with each of them separately but with a combination of all of them. [Dept. of Zoology, Faculty of Life Sciences, Tel-Aviv Univ., Ramat Aviv, Tel-Aviv 69978, Israel; e-mail: lotem@post.tau.ac.il.]—Jeffery P. Duguay.

10. **Dabbling duck behavior and aircraft activity in coastal North Carolina.** J. T. Conomy, J. A. Collazo, J. A. Dubovsky, and W. J. Fleming. 1998. *J. Wildl. Manage.* 62: 1127–1134.—Aircraft disturbances may influence the behavior and habitat use of various species of waterfowl. In North Carolina, a request to increase military aircraft activity prompted concerns about adverse impacts on waterfowl in the area. The objective of this study was to quantify behavioral responses of wintering waterfowl to aircraft disturbance. The authors used focal sampling to determine time-budgets of American Black Ducks (*Anas rubripes*), American Wigeons (*A. americana*), Gadwalls (*A. strepera*), and Green-winged Teal (*A. crecca carolinensis*). During observations, various behaviors were noted every 5 s along with the presence of aircrafts or aircraft noise. Additionally, the authors gathered information on sound levels during behavioral observations. Responses to disturbance included flying, swimming, and alert behaviors, and these responses occurred  $\leq 1.4\%$  of the total time budgets

for all species. In addition, very few individuals (13/672; 2%) responded to aircraft noise. The costs to each species are probably low due to the low number of responses, the brevity of response, and the quick return to resuming the activity disrupted by the disturbance. The authors suggest that the recorded levels of disturbance were not adversely affecting the time-budgets of the waterfowl in this study. However, they caution that these results are based on fixed wing aircraft and that findings of this study should not be extended to other species or for other types of aircraft. [U.S. Geological Survey, Biological Resources Div., North Carolina Coop. Fish and Wildlife Research Unit, North Carolina State Univ., Raleigh, NC 27695, USA]—Kerri T. Vierling.

## FOOD AND FEEDING

(see also 4, 9, 24)

11. **Need and nestmates affect begging in Tree Swallows.** M. L. Leonard and A. G. Horn, 1998. *Behav. Ecol. Sociobiol.* 42:431–436.—Conspicuous begging in young birds and mammals have produced a variety of plausible predictions. For instance, a substantial amount of data in avian studies show that the intensity of begging by offspring increases with increased hunger levels. In turn, parents have been shown to increase their feeding rates to nestlings in response to increased begging rates. Aside from these predictions, it is also possible that offspring begging is influenced by begging by nestmates independent of need. In this study, the authors examined 40 broods of 9-day old Tree Swallows (*Tachycineta bicolor*) to determine the degree of influence that nestmate begging versus hunger had on offspring begging. Broods were randomly placed into one of three treatments: (1) all nestlings in the brood deprived of food, (2) all nestlings in the brood fed, or (3) half of the brood deprived of food and half of the brood fed. All broods were examined during periods of pre- and post-treatment with a video camera. Maximum begging intensity between pre- and post-treatment observations increased significantly only for broods in which all nestlings had been food deprived. The proportion of deprived nestlings that begged, however, increased between the pre- and post-treatment periods, regardless of whether the entire brood or only half of the brood was food deprived. Maximum begging intensity and the proportion of nestlings begging from fed nests, decreased significantly between the pre- and post-treatment periods . . . and in this instance it made no difference whether nestlings were in broods in which all nestlings were fed or in broods in which only half of the nestlings were fed. Feeding rates by parents in the pre- and post-treatment periods increased significantly, but only in broods in which all nestlings had been deprived of food. Feeding rates by parents decreased both to broods in which all nestlings were fed and broods in which only half of the nestlings were fed. These data support the prediction that parental feeding rates are influenced by nestling hunger and that parents adjust their feeding rates according to the intensity of begging. In addition, the data back the notion that begging by broodmates also influences the intensity of nestling begging, independent of need. [Dept. of Biology, Dalhousie Univ., Halifax, Nova Scotia B3H 4J1, Canada; e-mail: Mleonard@is.dal.ca.]—Danny J. Ingold.

12. **Do males and females differ in the feeding of large and small siblings. An experiment with the Bluethroat.** P. T. Smiseth, T. Amundsen, L. T. Hansen. 1998. *Behav. Ecol. Sociobiol.* 42:321–328.—Differences in the amount of food provided by parents to their nestlings may have arisen as a result of cuckoldry patterns, differences in life-history strategies, or from sexual conflict over hatching patterns (Slagsvold 1994; *Nature*). The authors of this study experimentally manipulated within-brood-size in Bluethroats (*Luscinia s. svecica*) in order to obtain two nestling categories: large and small. The goals of this study conducted during one breeding season in southern Norway were to: (1) test for a sex difference in the food distribution pattern to nestlings both early and late in the season, with large and small size differences within broods, and (2) to test for a difference in the feeding behavior between the male and female. Although the authors cite several studies which document differences between male and female feeding rates in birds, they found no such differences in this study. Male and female food distribution was similar to nestlings in broods with both large and small size differences among them, and to nestlings both early and late in the season. When large size differences existed, both males and females disproportionately fed the larger nestlings more frequently; with small size differences, both adults fed all nestlings

at about the same rate. Early in the nesting period, males fed more nestlings during each feeding visit than did females (perhaps a reflection of cuckoldry patterns); later in the season this disparity leveled off. The authors pose four explanations for the absence of feeding pattern differences between male and female Bluethroats: (1) costs and benefits to males and females from feeding nestlings of different sizes are similar, (2) females are unable to increase the amount of care provided by the male by adjusting nestling size hierarchies, (3) costs through preferential feeding of small nestlings are low due to abundant food resources, and/or (4) nestling interactions prevent parents from preferential feeding of small nestlings. [Dept. of Zoology, Norwegian Univ. of Science and Technology, N7-7034 Trondheim, Norway; e-mail: per.terje.smiseth@chembio.ntnu.no.]—Danny J. Ingold.

13. **Diet of Montagu's Harrier *Circus pygargus* in central Spain: analysis of temporal and geographic variation.** B. E. Arroyo. 1997. *Ibis* 139:664–672.—The author conducted an assessment of within-year and between-year variation in the breeding season diet of Montagu's Harrier. Prey items were identified from pellets and prey remains collected from perch sites and nests in a 195-km<sup>2</sup> study area near Madrid, Spain. The author identified a total of 2425 prey individuals, including lagomorphs (principally hares, *Lepus granatensis*), small mammals, birds, bird eggs, reptiles, and insects. Insects, principally Orthoptera, were the numerically dominant prey (43% of all prey individuals), followed by mammals (27%) and birds (23%). Lagomorphs were probably only partially consumed (i.e., harriers usually could not carry hares away after killing them). However, lagomorphs accounted for 51% of the total prey biomass even when conservative estimates of actual biomass consumption were used. Proportions of prey categories differed among four reproductive periods (pre-laying, incubation, nestling, and post-fledging). Lagomorphs and small mammals were the most frequent prey in the pre-laying period, and birds and Orthoptera were the most frequent prey in the nestling and post-fledging periods. Generalized linear model procedures were used to test whether date or reproductive period had an effect on the probability of finding a particular prey category in the diet. Variation in lagomorph occurrence was explained by breeding period but not by date. Variation in birds was explained by both date and breeding period, and variation in the occurrence of all other prey types was explained only by date. According to the author, these findings suggest that Montagu's Harriers preyed on insects, eggs, and small mammals whenever they were seasonally available but preyed on lagomorphs preferentially in certain reproductive periods. Lagomorphs were consistently important early in the reproductive cycle, despite the fact that breeding phenology varied between years and between nests within a year. However, the relationship between annual shifts in breeding phenology and annual shifts in seasonal prey availability per se was not examined. This is the first study on Montagu's Harrier to find lagomorphs to be an important part of the diet throughout the season. Diet diversity for the species decreased with latitude, with the most diverse diet in Spain (this study) and the least in diverse in England and the Netherlands. [Edward Grey Inst. of Field Ornithology, Dept. of Zoology, Univ. of Oxford, So. Parks Rd., Oxford OX1 3PS, UK.]—Karl E. Miller.

14. **Waders in the Traicts du Croisic (Guerande marshes, Loire-Atlantique, West France): alimentary diet and impact on bivalve mollusc populations. [Les limicoles sejournant dans les traicts du croisic (Presqu'île Guerandaise, Loire-Atlantique): regime alimentaire et impact sur les populations de mollusques bivalves.]** S. Le Drean-Quenec'h du and R. Maheo. 1997. *Alauda* 65:131–149. [French, English summary, table and figure captions].—This study, conducted during 1994–95, is a quantitative assessment of the impact of shorebirds on natural and farmed bivalve mollusc populations in the Traicts du Croisic. During winter this ca 700 ha area supports 10,000+ waders, 95% of which are accounted for by 6 species. Dunlins (*Calidris alpina*) comprise 63% of the birds; Eurasian Oystercatchers (*Haematopus ostralegus*) 16%; Avocets (*Recurvirostra avosetta*) 14%. Mariculture (primarily cockles, *Cerastoderma edule*) occupies 176.5 ha. Food habits were determined by examination of stomach contents and observation of feeding birds. Primary feeding areas tended to be at the edge of or away from mariculture areas. Only the Oystercatcher was considered as potentially having a negative impact on commercial shellfish, since its diet consisted primarily of cockles. The authors estimated that the Oystercatcher consumed 195–309 tonnes of cockles during winter, although this represents only 1.3–2% of sown individuals and only 12–19% of the total recorded cockle mortality. Thus impact of birds on the commercial harvest of shellfish is con-

sidered minimal. [Laboratoire d'évolution des systèmes naturels et modifiés, Université de Rennes, Campus de Beaulieu, F-35042 Rennes CEDEX, France.]—Jerome A. Jackson.

15. **European Black Terns (*Chlidonias niger*) in trouble: examples of dietary problems.** A. J. Beintema. 1997. *Colon. Waterbirds* 20:558–565.—The Black Tern is declining in Western Europe, e.g., in the Netherlands numbers have been reduced by 90% this century. In eastern Europe there are indications that an increasing proportion of adults are leaving the breeding ground without raising chicks. The author provides a review of diet studies on European Black Terns. One reason for declining tern numbers is habitat alteration, but Black Terns are also declining in remaining wetlands. Pollution is one factor, particularly eutrophication due to agricultural wastes including phosphates and nitrogen, e.g., the dieoff in the 1950s and 1960s of water soldier (*Stratiotes aloides*) that was used as nesting substrate and protection against wave action. Most studies indicate that insects predominate in chick diets, but the percentage of fish is highly variable and has increased in recent years, suggesting a dietary shift by Western European terns. Impoverished agricultural habitats often do not provide adequate alternative prey when weather makes a favored prey type, such as dragonflies, temporarily unavailable, leading to chick starvation. Fish are an alternative resource when insects are unavailable, but acid rain has reduced fish abundance in many localities. The author cites diet studies demonstrating chick starvation in impoverished habitats and chick mortality from calcium deficiency in acid habitats. The author concludes that agricultural impoverishment may be the major problem for Black Terns in Europe and should be examined in the North American prairie region. This paper illustrates the complexity and subtlety of many conservation problems. [Institute for Forestry and Nature Research, P.O. Box 23, 6700 AA Wageningen, The Netherlands; e-mail: a.j.beintema@ibn.dlo.nl.]—William E. Davis, Jr.

#### SONGS AND VOCALIZATIONS

16. **Context determines the sex appeal of male Zebra Finch song.** O. Tchernichovski, H. Schwabl and F. Nottebohm. 1998. *Anim. Behav.* 55:1003–1010.—Fecal estrogen levels were successfully used to predict egg laying in female Zebra Finches (*Taeniopygia guttata*). Song broadcast from within a male model perched on the nest did not result in an increase in estrogen levels, but did when the model was away from the nest. Video taped experiments with live males and females revealed that song tended to occur most frequently away from the nest. The authors conclude that tests of song efficacy in female songbirds must respect some contextual rules in order to ascertain which sounds are most effective in inducing physiological changes leading to reproduction. [Rockefeller Univ. Field Research Center, Tyrell Rd., Millbrook, NY 12545, USA.]—Jeffrey P. Duguay.

17. **Correlates of hoot rate and structure in male Tawny Owls: *Strix aluco*: implications for male rivalry and female mate choice.** P. Galeotti. 1998. *J. Avian Biol.* 29:25–32.—Male Tawny Owls produce individually distinct territorial songs (three-note “hoots”) that remain the same over time. The author analyzed properties (hooting rate, “harshness,” and 13 structural characters) of the territorial songs of 22 male Tawny Owls to explore the potential for songs to impart information about male and/or territory quality. Territory quality was assessed by: (1) territory size, (2) territory stability (number of years of occupancy over a 7-year period), (3) reproductive output (number of fledglings produced over a 2-year period), (4) territory patchiness, and (5) territory fragmentation. Resource-holding potential was assessed by scoring the aggressiveness of the response of males to song playback in their territories. Based on principal components analysis, hooting rate and harshness were correlated with resource-holding potential (i.e., aggressiveness) but not with territory quality. Moreover, males increased their hooting rate when their mates participated in territorial defense. Note duration and frequency range were positively related to reproductive output and territory stability, indicating that vocalizations could act as signals of male and/or territory quality. It remains to be determined whether: (1) differences in vocal characters are honest signals, and (2) females use male vocalizations as cues in mate choice. [Dipartimento di Biologia Animale, Università di Pavia, I-27100 Pavia, Italy; e-mail: galeozot@ipv36.unipv.it.]—Jeff Marks.

18. **Call learning in Black-capped Chickadees (*Parus atricapillus*): the role of experi-**

**ence in the development of 'chick-a-dee' calls.** M. Hughes, S. Nowicki, and B. Lohr. 1998. *Ethology* 104:232–249.—While considerable research has been applied to the role of learning in song development, very little work has been done on the role of learning in the development of other vocalizations. In this study, 4 groups of chickadees were raised under different levels of social isolation. Chickadee calls produced by these birds were then compared to those produced by wild birds. It was found that the introductory note ('A-note') produced by all birds fell within the normal range of those produced by wild birds. However, the second and third notes ('B-note' and 'C-note') showed deviations from those of wild birds, and the extent of these deviations was correlated with the degree of isolation. Thus, it appears that the role of learning in the development of a vocalization may vary among specific elements within that vocalization. [Dept. of Zoology, Duke Univ., Durham, NC 27708-0325, USA; e-mail: snowicki@acpub.duke.edu.]—Jeffrey G. Kopachena.

**19. Embryonic calls as care-soliciting signals in Budgerigars, *Melopsittacus undulatus*.** K. E. Berlin and A. B. Clark. 1998. *Ethology* 104:531–544.—Budgerigar embryos emit vocalizations beginning one to two days prior to hatching, a phenomenon which has been observed in several precocial and semiprecocial species, but which has been poorly documented in altricial species. This study was designed to document the nature of these vocalizations and to test the hypothesis that embryonic vocalizations vary relative to temperature, thereby allowing embryos to solicit parental attendance, particularly with regard to nest temperature. Eggs containing vocalizing embryos were experimentally exposed to different temperature regimes and their call rates and length of calling bouts were measured. In addition, playback experiments of embryonic calls were conducted on parents with near-hatching eggs to monitor parental responses to embryonic vocalizations. Finally, calls from embryos and newly hatched nestlings were compared spectrographically to determine whether these calls were structurally different. Calling rates by embryos increased at high temperatures and were also more frequent closer to hatching. However, there was little evidence of increased calling at low temperatures, a result that differs from studies that have been conducted on semiprecocial species. Experimental nests, with playbacks of embryonic vocalizations were characterized by higher levels of parental attendance to eggs, particularly shifting the eggs. Embryonic vocalizations were simple, being a single continuous frequency emission, while newly hatched nestlings had vocalizations that were continuous, but had harmonics at three or four frequencies. The lack of difference in vocalizations at low and normal temperatures suggests that embryonic vocalizations in this species might not function specifically to increase parental thermoregulatory behaviors as has been suggested for some semiprecocial species. However, the increased parental attentiveness to eggs that emit vocalizations suggest that the function of these vocalizations may be to alert parents to the imminence of hatching and might solicit parental assistance of hatching. [Dept. of Biological Sciences, Binghamton Univ., Binghamton, NY 13902-6000, USA; e-mail: aclark@binghamton.edu.]—Jeffrey G. Kopachena.

**20. Male song stimulation of female reproduction in Canaries: Features relevant to sexual displays are not relevant to nest-building or egg-laying.** G. Leboucher, V. Depraz, M. Kreutzer, and L. Nagle. 1998. *Ethology* 104:613–624.—In Canaries (*Serinus canaria*) a specific type of song phrase ('sexy' phrase) has been shown to stimulate female copulation solicitations. This study was designed to test whether such phrases also stimulated other aspects of female reproduction, specifically nest-building and egg-laying. Two classes of females (naive yearlings and experienced) were exposed to 'sexy' songs containing 'sexy' phrases, 'non sexy' songs that did not contain 'sexy' phrases, or no songs (control groups). The results confirmed that 'sexy' songs resulted in copulation solicitations among both classes of females. Females showed increased nest-building in the presence of songs than when songs were not played. However, nest-building activities did not differ between females exposed to 'sexy' or 'non-sexy' songs. There was no effect of female experience on the extent to which song stimulated nest-building behavior. However, there was an experience effect when the influence of song on egg-laying was examined. Yearling, naive females exposed to either 'sexy' or 'non sexy' songs had shorter egg-laying latencies and laid more eggs than did yearling females not exposed to song. As before, responses did not differ relative to song type. Experienced females did not show any differences in egg-laying behavior relative to the presence or absence of song or the type of songs played. In general, the results indicate that 'sexy' phrases stimulate copulation solicitations but are not particularly involved in stimulating nest-building or egg-laying. However, the

fact that songs, in general, seem to stimulate nest-building and, at least among naive females, egg-laying, suggests that other elements of male song may serve to facilitate these latter activities. [Gerard Leboucher, laboratoire de Psychophysiologie et d'Ethologie, Batiment H, Université de Paris X-Nanterre, 200 Av. de la République, 92001 Nanterre Cedex, France; e-mail: Gerard.Leboucher@leec.univ-paris13.fr.]—Jeffrey G. Kopachena.

### NESTING AND REPRODUCTION

(see also 3, 8, 9, 11, 12, 17, 19, 20, 35, 37, 39, 42)

21. **Extra-pair mating system of a synchronously breeding tropical songbird.** B. J. M. Stutchbury, E. S. Morton, and W. H. Piper. 1998. *J. Avian Biol.* 29:72–78.—The recent spate of DNA fingerprinting studies has made clear the fact that at least in temperate latitudes, many socially monogamous passerines are genetically polygamous. Much less is known about mating systems in tropical passerines. Because breeding synchrony is positively correlated with the frequency of extrapair fertilizations (EPF) in many passerines, tropical species might be expected to exhibit low rates of EPF because their breeding seasons tend to be more protracted than those of temperate passerines. Indeed, several studies have found few or no EPFs in socially monogamous tropical passerines that breed asynchronously. The relationship between breeding synchrony and EPFs is far from clear, however, so more studies are needed. If low breeding synchrony promotes genetic monogamy in the tropics, then tropical species that do breed synchronously should exhibit relatively high rates of EPFs. Stutchbury et al. tested this prediction in Clay-colored Robins (*Turdus grayi*) in Panama during 1994 and 1995. Clay-colored Robins are socially monogamous and initiate breeding relatively abruptly during the dry season; consequently, their breeding synchrony more closely resembles that of temperate passerines than of tropical species. Overall, 10 of 19 females (53%) produced extrapair young, and 14 of 37 young (38%) were sired by males other than their social fathers. These rates are comparable to those of many temperate passerines. Moreover, nests that contained extrapair young had a significantly higher synchrony index than those without extrapair young. Thus, the data support the prediction that breeding synchrony facilitates EPFs. Other factors, such as breeding density and/or rapid pair formation, could influence the frequency of EPFs independent of breeding synchrony. Additional studies of tropical species that differ in density and breeding synchrony, and comparisons of congeners that reside in tropical and temperate latitudes, are needed to further understand the factors that select for extrapair mating systems in birds. [Dept. of Biology, York Univ., North York, ON M3J 1P3, Canada; e-mail: bstutch@yorku.ca.]—Jeff Marks.

22. **The costs of incubation in the British Storm-Petrel: an experimental study in a single-egg layer.** E. Mínguez. 1998. *J. Avian Biol.* 29:183–189.—Procellariiforms are long-lived seabirds whose single eggs take an unusually long time to hatch for their size. Thus, the average incubation period should reflect a balance between parental investment in incubation versus survival and future reproduction. The author exchanged eggs in nests of British Storm-Petrels (*Hydrobates pelagicus*) in which egg-laying dates differed by an average of nine days. Although hatching success declined as the incubation period increased, neither fledging success (i.e., the proportion of hatched chicks that fledged) nor nesting success (i.e., the proportion of eggs laid that resulted in fledged chicks) was affected by experimental manipulations of incubation length. Nor did the manipulations affect nestling growth to 10, 40, or 50 days of age. Laying rate, hatching success, and nesting success in the subsequent year also were not affected by the manipulations. However, prolongation of incubation in the first year resulted in later laying dates in the next year, especially among pairs that nested successfully. This suggests that incubation is costly and that the length of the incubation period can influence future reproductive decisions in long-lived birds. Presumably, the increased incubation length affected parents by increasing their energy expenditure and/or prolonging the cessation of breeding behavior, which may have altered the timing of events controlled by the endocrine system. [Estación Biológica de Doñana (CSIC), Pabellón del Perú, E-41013 Sevilla, Spain; e-mail: eminguez@ebd03.ebd.csic.es.]—Jeff Marks.

23. **Weather and breeding success at high latitudes—the Pied Flycatcher *Ficedula hypoleuca* and the Siberian Tit *Parus cinctus*.** S. Veistola, E. Lehtikoinen and T. Eeva. 1997. *Ornis Fennica* 74:89–98.—It is widely known that breeding success is strongly dependent



upon both physiological and environmental conditions. The influence that environmental conditions exert upon the reproductive success is difficult to ascertain. In attempt to determine the extent upon which environmental conditions affect reproduction, breeding success of two hole nesting species, the Pied Flycatcher and the Siberian Tit was examined. Foraging behavior, feeding frequency and diet were examined to determine the functional responses of the two species to weather. Losses in both the egg laying and nestling phase and their relation to weather factors were also analyzed. The Pied flycatcher is a relatively recent breeder in Lapland, the northern extent of its range. The Siberian Tit is native and well adapted to the climatic conditions. It is generally sedentary and possesses many adaptations to low temperatures to ensure high probability of nesting success. Cold periods had virtually no discernable effect on nestling survival. Foraging strategy, diet and feeding frequency remained consistent, even at lower than normal temperatures. However, a greater proportion of winged insects in the nestlings' diet occurs in colder temperatures. No link between nestling mortality and climate could be made. Pied Flycatchers had low mean hatching success in marginal breeding areas. Males were unable to adequately feed their mates, necessitating females to be away from the nest for long periods of time. Overall, laying starts when conditions are still too cold for this species, however, the summer here is too short for females to wait for more favorable breeding conditions. Lower egg hatchability suggests this species is at the upper limits of its range in Finnish Lapland. Foraging behavior, diet and fledging success were found to be clearly connected with weather conditions. Nestling growth was found to be strongly affected by weather conditions. Differing morphologies and life histories assist the Siberian Tit to be much more adept at surviving these conditions. Pied Flycatchers have not evolved to effectively deal with the colder environment of this area, needing warmer weather conditions for its primary food source, arthropods. [Veistola, S., Lehtikoinen, E. & Eva T., Laboratory of Ecological Zoology, Dept. of Biology, Univ. of Turku, FIN-20014 Turku, Finland.]—Sue Bennett Canale.

24. **Reduced availability of refuse and breeding output in a Herring Gull (*Larus argentatus*) colony.** M. Kilpi & M. Öost. 1998. *Ann. Zool. Fennici* 35:37–42.—The effect of land-fill closure on breeding performance in a colony of Herring Gulls was examined within a well established, stable colony. Many gull species have had substantial population increases as the result of modern day refuse handling. The availability of consistent food supplies over large portions of this species' range in the Finnish archipelagoes were thought to have resulted in the dependency of the breeding population of these dumps. Localization of landfills away from coastal archipelago and overall improvements in refuse handling has led to closure of some land fills and reduced the availability of the refuse as a food source. If gulls were dependent upon these dumps for foraging during the breeding season, then a decrease in productivity and ultimately the population of breeders should be observed. Breeding performance in the year prior to closing (1996) of the last available garbage dump and the year following closure (1997) was examined. Fifteen to twenty percent of the observed pairs were known to be utilizing the dump for food during both courtship and brood rearing. In 1996, weather patterns were poor, resulting in a late start to the breeding season. By comparison, 1997 was unusually warm and calm, and saw an earlier start to the breeding season. Fledging success at the colony in 1997 was found to be low (50%) when compared to 1996 (62%). Increases in chick mortality were also noted in 1997. Although there were no direct observable causes, qualitative observations suggested that a higher number of deceased chicks were older (larger) than what had been observed in prior years. Previous observations on this colony noted that most chick mortality occurred during the first 10 days of life. In large gulls, the size of the third (or last laid) egg may be directly linked to pre-breeding food supply. Therefore, a decrease in relative and absolute size of the third egg would be expected in the 1997 data if the garbage dump were a main food source for the gulls. The size of the last egg laid was found to be significantly smaller than previous years. Further, egg size asymmetry in 1997 was the greatest that had been measured in the colony which had been studied since the early 1980s. The number of nests having two eggs as a full clutch increased markedly in 1997, as did overall nest predation. Hatching weight of chicks saw no change, but the growth of first chicks was noted to be slower in 1997. The effects observed on breeding success post dump closing were found to be consistent with other studies and show that diminishing food resources are very likely the causative agents of the breeding

results observed in 1997. The authors conclude that the dump closing had a slight effect on all phases of breeding. Breeding adults spent more time away from their territories in search of food, which probably accounts for greater egg predation seen in 1997. The smaller clutch size with notably smaller egg size is consistent with diminishing food resources. Evidence suggests that while the availability of a garbage dump in not a key factor in regulating reproductive performance, it may be important for overall survival outside of the breeding season. [Dept. of Ecology and Systematics, Zoological Laboratory, P.O. Box 17, FIN-00014 Helsinki Univ., Finland].—Sue Bennett Canale.

25. **The first breeding success in the Short-tailed Albatross colony restoration project on Tori-shima, using decoys and vocal lure.** F. Sato, K. Momose, M. Tsurumi, T. Hiraoka, A. Mitamura, and T. Baba. 1998. *J. Yamashina Inst. Ornithol.* 30:1–21. [Japanese, English abstract, figure and table captions].—Add the rare (ca 180 breeding pairs) Short-tailed Albatross (*Diomedea albatrus*) to the growing list of birds that have been successfully attracted to potential nesting areas by using decoys and sound recordings. While most of this species, about 170 pairs, were nesting already on Tori-shima, they were nesting on a steep volcanic talus slope and the loose gravel has been thought to provide a poor environment resulting in low breeding success. Use of decoys and recorded albatross calls, the authors were successful in attracting the birds to a new site on the opposite side of the island. Decoys were first put at the site in 1992, more decoys were added, then a vocal lure was added in the spring of 1993. By 1994 there were 69 decoys present. Black-footed Albatrosses (*D. nigripes*) were also nesting at the site. Five Short-tailed Albatrosses landed at the site in 1993; 5, 29, and 41 were seen there in 1994, 1995, and 1996. Length of stay steadily increased. In November 1995 one pair successfully fledged a chick at the site; in November 1996, three pairs built nests and two laid eggs. Success was neither immediate nor great, but clearly long-term efforts can pay off. [Yamashina Institute for Ornithology, 115 Konoyama, Abiko, Chiba 270-1145, Japan].—Jerome A. Jackson.

26. **Reproduction of the Northern Lapwing *Vanellus vanellus* and farming techniques: characteristics of breeding sites in maritime lowland Picardy. [Reproduction du Vanneau Huppe *Vanellus vanellus* et pratiques agricole caractéristiques des sites utilisés en plaine maritime Picarde.]** P. Triplet, J. Durant, and S. Bacquet. 1997. *Alauda* 65:121–130. [French, English summary, figure, and table captions].—Although the density of breeding Northern Lapwings in lowland Picardy (northern France) is among the highest in Europe, nesting success there varies with habitat. Lapwings nesting in grassland habitats were most successful. Breeding density increased with moderate grazing (<2 cattle/ha), but then decreased with increased cattle density. Attempted nesting in green pea fields nearly always failed. [Reserve Naturelle Baie de Somme (SMACOPI) 1, Place de l' Amiral Courbet, F-80 100 Abbeville, France].—Jerome A. Jackson.

27. **Changes in Black Woodpecker (*Dryocopus martius* L.) cavities. [L'évolution des nids du Pic Noir (*Dryocopus martius* L.).]** M. Cuisin. 1997. *Alauda* 65:198–199. [French, English summary].—As with other woodpeckers, the roost/nest cavities of the Black Woodpecker are used by a diversity of bird and mammal species. When the cavities are excavated in living trees, they may serve the cavity-nesting community for many years. Cuisin followed 3 such cavities in living beeches (*Fagus sylvatica*) and found that the cambium grew over the cavity entrance, decreasing it in size over time and ultimately sealing off the cavities after 20, 27, and 30 years. [40, Rue Pierre Comielle, F-7800 Versailles, France].—Jerome A. Jackson.

28. **A long term study of factors influencing the breeding success of the Cattle Egret in Australia.** N. G. McKilligan. 1997. *Colon. Waterbirds* 20:419–428.—The author reports on an analysis of 10 years of breeding season data (1979–1989) for Cattle Egret (*Bubulcus ibis*) heronries in the Lockyer Valley, an agricultural and grazing region near Gatton, Queensland. Breeding success (mean number of chicks fledged per successful nest) was variable among years and the analysis was aimed at identifying factors that influenced the variation. Cattle Egrets began nesting in the Lockyer Valley in 1974, and the population stabilized at about 3500 breeding pairs by 1982. The author noted that the presence of a drinking water source near the colony was essential for nesting. Each season the number of chicks per nest was recorded on visits when the chicks were young and again when the broods were near fledging, as a measure of chick mortality. Regurgitates were collected and analyzed. Regression

analysis (single-stage tests) of a number of weather, pasture growth, and prey item variables suggested that spring rainfall, percent weight of grasshoppers and locusts (Acrididae) in chick diet, and the mean weight of Acrididae nymphs were associated with reduced chick mortality. Other tests suggested a positive association between advanced brood sizes and spring rainfall, spring pasture growth, and percentage weight, size and number of Acrididae. However, when the data were analyzed using multi-stage tests no significant correlations were found. The author uses the results to construct a circumstantial case that chick starvation underlies annual variations in Cattle Egret breeding success, and proposes a model in which above average spring rains promote pasture growth that in turn supports large populations of Acrididae, thus providing Cattle Egrets with an abundant food resource during the nesting season. [Biology Dept., Faculty of Sciences, Univ. of Southern Queensland, Toowoomba, Qld. 4350, Australia.]—William E. Davis, Jr.

29. **Theft of nesting material involving honeyeaters (Meliphagidae).** A. J. Ley, D. L. Oliver, and M. B. Williams. 1997. *Corella* 21:119–123.—The authors report on observations of nesting material reuse or piracy by 12 bird species in the Bundarra-Barraba region of New South Wales, Australia. During a comprehensive nesting study of the endangered Regent Honeyeater (*Xanthomyza phrygia*), 6 bird species were observed kleptoparasitizing active Regent Honeyeater nests, and a total of 10 honeyeater species were observed kleptoparasitizing nesting material from active nests of 8 other species. Additional observations are presented of birds retrieving nesting material from abandoned nests of other species or from their own earlier nesting attempts. The authors discuss the likely gains from nesting material piracy (e.g., flight time and energy saved) and potential disadvantages (e.g., aggression by nesting birds or acquiring parasites such as lice or fly larvae along with nesting material). The authors conclude that nesting material kleptoparasitism can potentially cause nest failure in the parasitized bird. In one example, a Fuscous Honeyeater (*Lichenostomus fuscus*) had broken through the wall of a nest and was removing lining material. Kleptoparasitism may be common among honeyeaters, and could be increasing in fragmented and degraded habitats to the detriment of already declining species such as the Regent Honeyeater. This is an interesting paper with potentially important conservation implications. [19 Lynches Road, Armidale, NSW 2350, Australia.]—William E. Davis, Jr.

30. **Nest-site selection by Cooper's Hawks in an urban environment.** C. W. Boal and R. W. Mannan. 1998. *J. Wildl. Manage.* 62:864–871.—Cooper's Hawks (*Accipiter cooperii*) may be negatively affected by urbanization through the loss of habitat and human disturbance; however, some individuals are found nesting in urban areas. The authors characterized nest-site selection of Cooper's Hawks in a highly urbanized area of Tucson, AZ. The authors found 33 nests in central Tucson and measured nest site attributes pertaining to the nest tree and surrounding vegetation characteristics. In addition, they measured the same attributes at randomly selected sites. Cooper's Hawks nested preferentially in introduced eucalyptus (*Eucalyptus* spp.) and aleppo pine (*Pinus halepensis*) trees, and these trees were taller and of greater diameter than random trees. In addition, canopy cover, basal area, and the number of trees >10 m tall were higher in occupied sites than in random sites. Cooper's Hawks apparently selected groves of trees, and did not appear to respond to different levels of human disturbance. For instance, the authors found that the majority of nest trees occurred in high-density residential areas or in high-use recreational areas. The high density of Cooper's Hawks in Tucson (1 nest/437 ha) may have been associated with large trees, the proximity and abundance of water, and the abundance of prey (i.e., doves) in the city. The authors suggest that the continued presence of eucalyptus and aleppo pine trees may be beneficial for Cooper's Hawks. They also note that native cottonwoods may be viable alternatives since Cooper's Hawks also nested in these trees. However, the amount of water required by cottonwoods may preclude the city from planting these trees. [School of Renewable Natural Resources, Univ. of Arizona, Tucson, AZ 85721, USA; e-mail: cboal@ag.arizona.edu.]—Kerri T. Vierling.

31. **Extra-pair mating effort of male Hooded Warblers, *Wilsonia citrina*.** B. J. M. Stutchbury. 1998. *Anim. Behav.* 55:553–561.—Stutchbury radio-tagged 10 male Hooded Warblers to investigate the effort spent by males in seeking extra-pair copulations (EPCs) with neighboring females. Most intrusions took place onto territories where females were nest building and males also intruded onto territories where females were vocalizing more often than

expected by chance. This suggests that intrusions are aimed at obtaining EPCs. Males making the most intrusions were least likely to have other males intruding onto their territories, suggesting that some males are successful both at seeking EPCs and avoiding cuckoldry. From this study, it appears that the time spent intruding onto neighboring territories and the risk of cuckoldry as a result of being off-territory are not major costs. Stutchbury addresses the need to investigate the balance of male and female EPC tactics and the conflict of interest between social mates. [Dept. of Biology, York Univ., North York, Ontario M3J 1P3, Canada; e-mail: bstctch@york.ca.]—Jeffrey P. Duguay.

32. **Activity rhythm at nest of the Kingfisher, *Alcedo atthis*.** R. Isotti and C. Consiglio. 1997. *Sitta* 67:55–59.—The authors report observations made at two Kingfisher nests along the Tiber River near Rome during the spring and summer of 1991. Movements of the birds to and from the nests were recorded by means of an infrared beam and an actograph. All activities of the Kingfishers were restricted to daylight hours. Cavity excavation was concentrated in short periods interspersed with long periods of inactivity. The nest tunnel was empty at night. During incubation, movements were infrequent and periods of attentiveness were long, however there were significant differences in the level of activity at the two nests. During incubation there was a negative correlation between mean daily temperature and frequency of adult movements ( $P < 0.005$ ), and a positive correlation between mean daily relative humidity and frequency of adult movements ( $P < 0.015$ ). There was no association between periods of rainfall and frequency of adult movements to or from the nest. [Via Santa Maria della Speranza 11, 00139, Rome, Italy].—Jerome A. Jackson.

### MIGRATION, ORIENTATION, AND HOMING

(see also 45)

33. **Why is there no transpolar bird migration?** G. A. Gudmundsson and T. Alerstam. 1998. *J. Avian Biol.* 29:93–96.—Birds migrate over many portions of the Arctic Ocean, but migration across the North Pole is unknown. Tracking radar in place near the pole (85 to 90°N) for 211.5 h between 24 Jul. and 18 Sept. 1996 yielded no radar echoes from migrating birds, confirming that bird migration is virtually absent in the polar region. The authors offer two possible explanations for the absence of transpolar bird migration: (1) such migration may not be advantageous given the geographic location of breeding and wintering areas of migrants, and (2) orientation may be difficult near the North Pole. The latter explanation is especially important because stars are not visible during the polar summer, and the geomagnetic field in this region is especially weak. [Icelandic Institute of Natural History, P.O. Box 5320, IS-125 Reykjavik, Iceland; e-mail: mummi@nattfs.is.]—Jeff Marks.

34. **The effects of zinc sulphate anosmia on homing pigeons, *Columba livia* in a homing and non-homing experiment.** C.A. Budzynski, R. Strasser, and V. P. Bingman. 1998. *Ethology* 104:111–118.—Experiments with anosmic pigeons have been used to support the hypothesis that homing pigeons use olfactory cues as aids to navigation. However, these results have been questioned owing to the possibility that the process of rendering birds anosmic might impair general information processing. This study was designed to test whether anosmic pigeons showed any evidence of impaired general information processing. First it was demonstrated that navigation deficits resulted from zinc sulphate-mediated anosmia. Second, zinc sulphate treated birds were tested with a forced choice task in a T-maze, a test designed to demonstrate memory impairment. The results of this latter experiment demonstrated that zinc sulphate-mediated anosmia did not reduce memory performance during maze trials. Thus, the study supports the hypothesis that homing pigeons do use olfactory cues to navigate from unfamiliar locations. [Dept. of Psychology, Bowling Green State Univ., Bowling Green, OH 43404, USA; e-mail: cherib@bgnet.bgsu.edu.]—Jeffrey G. Kopachena.

### HABITAT USE AND TERRITORIALITY

(see also 8, 23, 24, 25, 26, 28, 30, 38, 40, 42, 45, 48, 49, 50)

35. **Influence of cliffs on bird community diversity.** J. D. Matheson and D. W. Larson. 1998. *Can. J. Zool.* 76:278–287.—The authors examined avian communities in forested cliff habitats by establishing census transects perpendicular to cliff edges. They identified four

zones: plateau (125 m away from the cliff edge), cliff edge (up to 25 m away from the edge proper), cliff face, and talus slope. Bird species richness was greater in the three cliff zones than on the plateau. Species richness was also greater in the cliff zones than that predicted for a forest tract of equal size. Most species found on the plateau were also found in the cliff zones, but many other species were unique to the cliff zones. Birds found in the cliff zones included some classified as forest interior species, suggesting that some feature provided by the cliff habitat (such as enhanced protection from predators) is attractive to them, in spite of the high degree of habitat edge. The authors conclude that cliff habitats contribute significantly to local bird species diversity. [Dept. of Botany, Univ. of Guelph, Guelph, ON N1G 2W1, Canada; e-mail: dwlarson@uoguelph.ca]—Scott W. Gillihan.

### ECOLOGY

(see also 6, 7, 8, 21, 23, 26, 28, 35, 41, 43, 44, 45, 48, 49, 50)

36. **Seasonal pattern in age, sex and body condition of Barn Owls *Tyto alba* killed on motorways.** S. Massemin, Y. Le Maho, and Y. Handrich. 1998. *Ibis* 140:70–75.—One hundred seventy-nine Barn Owls killed on French motorways between 1991–1994 were examined for age, sex, and body condition. The number of Barn Owls killed on roads was highest during the nonbreeding period between early autumn and late winter. Two maxima in this mortality were evident: a peak in autumn that consisted mainly of immature birds (84% of total individuals), and a second peak in late winter that consisted mainly of mature birds (65% of total individuals). Mortality was related to the coincidence between peak motorway traffic and owl hunting activity; i.e., during winter, shortened days meant that peak evening traffic coincided with the hour of sunset, which is also when owls initiated hunting. The autumn peak in mortality also may have been related to the vulnerability of owls during post-fledging dispersal movements. More than twice as many immature females as immature males were collected from roadways in autumn, which is consistent with the fact that female owls are known to disperse farther distances than male owls. With the exception of adult females, Barn Owls killed on motorways were in good body condition compared with captive owls of the same age and sex. [Centre d'Ecologie et Physiologie Energétiques, CNRS, 23 rue Becquerel, 67087 Strasbourg, France.]—Karl E. Miller.

37. **Costs of brood parasitism and the lack of defenses on the Yellow-winged Blackbird-Shiny Cowbird system.** V. Massoni and J. C. Reboreda. 1998. *Behav. Ecol. Sociobiol.* 42:273–280.—Shiny Cowbirds (*Molothrus bonariensis*) are obligate brood parasites, that lay two egg morphs: spotted eggs throughout most of their range and white-immaculate eggs in portions of their range in Argentina and Uruguay. Some host species accept both egg morphs while others accept only spotted eggs. There have been no documented instances in which a host rejects the spotted eggs while accepting the white ones. In this study the authors examined Yellow-winged Blackbirds (*Agelaius thilius*), a host of the Shiny Cowbird in Argentina, in order to determine: (1) the rate and cost of Shiny Blackbird parasitism on this species, and (2) whether Yellow-winged Blackbirds have developed any anti-parasitic defenses such as egg rejection against a particular egg morph. The overall parasitism rate by Shiny Cowbirds was 27% (31 of 117 nests). Significantly more Yellow-winged Blackbird nests that had been parasitized contained punctured eggs (83%) versus non-parasitized nests (30%), and nests with punctured eggs were significantly more likely to be deserted. Predation was the main cause of nest failure in Yellow-winged Blackbirds and during the nestling stage, parasitized nests experienced higher predation rates (90%) than did non-parasitized nests (35%). The nesting success of parasitized blackbird nests was lower (3.2%) than for non-parasitized nests (17.4%), and the number of blackbird eggs at the time of hatching was significantly smaller in parasitized nests. Conversely, although parasitized nests had fewer blackbird eggs, there was no significant parasitic effect on the hatching or fledging success in Yellow-winged Blackbirds. The authors documented no instances of egg rejection of either egg morph in either naturally or artificially parasitized nests. Only one Shiny Cowbird chick fledged (2.7%) from 37 cowbird eggs laid in 31 blackbird nests. The authors discuss two hypotheses that address the apparent lack of antiparasitic defenses in the Yellow-winged Blackbirds. They also discuss the functional significance of the white-immaculate eggs of the Shiny Cowbird. [Dept. de Ciencias Biológicas, Facultad de Ciencias Exactas y Naturales, Univ. de Buenos Aires, Pabellón

II Ciudad Universitaria, 1428 Buenos Aires, Argentina; e-mail: massoni@bg.fcen.uba.ar.]—  
Danny J. Ingold.

38. **The Lesser Kestrel (*Falco naumanni*) in the Ebro valley: populations, habitat use, demography, and conservation.** [El cernicalo primilla (*Falco naumanni*) en el valle del Ebro: poblaciones, uso del habitat, demografía y conservación.] J. A. Donazar, J. L. Tella, M. G. Forero and F. Hiraldo. 1998. Anuario Ornitológico de Navarra 1996 3:11–19. [Spanish, English abstract and figure captions].—Small populations of the Lesser Kestrel are localized in the Ebro River valley. Most nests were found in the roofs of isolated farm buildings. In intensively cultivated areas, this kestrel hunted over a larger home range and took smaller, generally invertebrate, prey. The authors suggest that survival of the species in the Ebro valley will require maintenance of the traditional system of agriculture—a mix of cultivated fields and grazed lands. [Estacion Biologica de Donana, C.S.I.C., Avda Ma Luisa s.n., 41013, Sevilla, Spain].—Jerome A. Jackson.

39. **Survival prospects of single-brooded and double brooded Rock Pipits *Anthus petrosus*.** M. Hario. 1997. Ornis Fennica 74:99–104. Rock Pipits in northwestern Europe arrive on their breeding grounds in early spring and leave late in the fall, facilitating a long breeding season and thereby allowing for an appreciable segment of the female population to double brood. Given that egg production is expensive energetically, previous studies have suggested that birds producing two broods in a season would ultimately have lower survival. To determine if double-brooding does exhibit an effect on the lifespan of these birds, a small, color-banded migratory population of Rock Pipits was examined. Birds of both sexes were examined in their first year of breeding. The possibility of the existence of phenotypic traits that may predict a tendency towards one strategy over another was also examined. Site tenacity among nesting birds is known to be quite high among established birds. Of 60 color-banded birds, only one female was found to have moved to another island after breeding for the previous 2 years on the study island. There were no recorded instances of established breeders disappearing one year and re-appearing the next. Therefore, color-banded birds not re-sighted were presumed dead. Overall, the lifespan of female Rock Pipits was 1.6 breeding seasons, producing 2.4 broods. The population distribution was strongly skewed towards first year birds. Of females, 70% lived only one breeding season and produced 42% of all the broods. Males lived on average 2.0 breeding seasons and produced 2.8 broods. Of males, 57% were found to live only one season and produce 28% of the broods. Most single brooded birds were found to be yearlings, and double broodedness increased correspondingly with increasing age. The frequency of producing double broods decreased only in years where winter had been harsh. Of the several variables measured for determining predictability, only the timing of the onset of breeding was different in single vs. double brooded birds. Single brooded birds initiated their first clutch an average of 15 days later than did double-brooders. The fledging date of the second brood of double brooders was 37 days after their first brood. In their debut year of breeding, double-brooded birds of both sexes were found to have larger first broods than those producing single broods, but this was not statistically significant. This is consistent with previous findings that following the debut year, second broods become larger than first broods. The author concludes that single brooded birds do so largely because of timing constraints. By initiating breeding roughly two weeks after double-brooded birds, a theoretical second brood would occur while the birds were heavily moulting. In double-brooded birds, wing molt begins while the second brood is still being tended to. For yearling males, a slight tendency exists for double-brooded birds to be linked to greater survival, indicating that double-brooded males are of higher quality. The author suggests that a possible explanation for these differences is due to the heavier energy constraints placed on the female. [Finnish Game & Fisheries Research Institute, PB 202, FIN-00151 Helsinki, Finland; E-mail: martti.hario@rilt.fi].—Sue Bennett Canale.

40. **Effects of eucalypt dieback on bird species diversity in remnants of native woodland.** K. B. H. Er. 1997. Corella 21:101–111.—Dieback, characterized as “a symptom of ecosystem dysfunction,” involves a progressive dying of branches resulting in tree death. It is a complex phenomenon, an element of which is bird predation on defoliating insects; reduction in bird species richness and density may accelerate dieback. This study, which involved 102–600 ha study plots, assesses the effects of dieback on remnant woodland bird communities. Each plot was censused each season during 1994 and a bird species diversity index

and abundance estimate calculated from pooled data. Bird species were also grouped by foraging height (canopy, sub-canopy, shrub, ground), and by substrate and diet (e.g., insectivores: foliage, ground, aerial, and bark). Dieback estimates were made for each plot. Linear regression analysis indicated a significant reduction in bird species diversity with increasing dieback. However, further analysis indicated that the sub-canopy was the only height category in which the species diversity-dieback correlation was significant. A more complex relationship was found between dieback and bird density, where a significant effect was only obtained when two sites with atypical values were excluded from the analysis. Granivorous birds appeared to be less affected by dieback than insectivores, and among insectivores the aerial group was least affected. The author suggests that the decline in bird species diversity and density results more from loss of tree cover and concomitant loss of protection from predators and environmental effects such as wind or extreme cold and heat, than from decreased insect abundance. In one study plot where a dense shrub layer may have compensated for lost tree cover, bird density remained high, while in another plot which had no shrub layer, species diversity and density were very low. The author focuses discussion on honeyeaters (Meliphagidae) (mainly generalized insectivores), a group which experienced significantly reduced species diversity with increased dieback. The exclusion of smaller insectivorous honeyeaters by aggressive species such as Noisy Miners (*Manorina melanoccephala*) may accelerate dieback. The author concludes that dieback in woodland remnants may have a serious impact on wintering and migrant honeyeaters. [Dept. of Forestry, School of Resource and Environmental Management, Australian National Univ., Canberra, ACT 0200, Australia.]—William E. Davis, Jr.

#### POPULATION DYNAMICS

(see also 24, 25, 28, 35, 36, 38, 40, 42, 43, 45, 48, 49, 50)

41. **Ruffs (*Philomachus pugnax* L.) in northern Senegal, composition of the population by sex and age groups.** [Les Chevaliers Combattants (*Philomachus pugnax* L.) dans le nord du Senegal.] B. Treca. 1997. *Alauda* 65:161–166. [French, English summary and figure captions].—In conjunction with a food habits study, 641 Ruffs were killed in northern Senegal. All birds were sexed by examination of gonads and aged by the presence or absence of the bursa of Fabricius. Although there might be some bias towards adult males expected as a result of their larger size and conspicuous plumage, observed sex ratio revealed significantly more females. Sex and age ratios varied seasonally: 2.2 females/male between August and January, 4.1 females/male in February and March. The first fall migrants to arrive in August were all adults. In September 6% of females and 22% of males were immature. By October, 50% of females and 63% of males were immature. Immatures continued to outnumber adults through the winter. Only one male, an adult, was collected in April, none in May. Most females collected in May were immature. [Laboratoire d'Ornithologie, ORSTOM, B.P. 1386, Dakar, Senegal.]—Jerome A. Jackson.

#### ZOOGEOGRAPHY AND DISTRIBUTION

(see also 23, 24, 25, 26, 28, 41, 48, 49, 50)

42. **Distribution and status of Least Tern nesting colonies in southeast Florida.** R. Zambrano, M. S. Robson, D. Y. Charnetzky, and H. T. Smith. 1997. *Florida Field Nat.* 25:85–91.—Beachfront development in Florida has reduced ground-nesting habitat for terns, particularly the Least Tern (*Sterna antillarum*) which is listed as a threatened species. Previous studies in Florida have found that Least Terns will use artificial substrates such as gravel-and-tar roofs for nesting. In 1995, the authors surveyed six counties in southeast Florida for nesting Least Terns and recorded a minimum of 1437 breeding pairs in 29 active colonies. Twenty-seven (93%) of the colonies were located on roofs, and only 2 (7%) were located on natural substrates (i.e., beach or coral rock). Reliance on artificial nesting substrates was higher than in any previous survey conducted in the state. Although more breeding pairs were found in southeast Florida in this study than in surveys conducted in the 1970s, the authors caution that population trends can be determined only through more frequent and intensive surveys. Moreover, the authors suggest that increasing use of plastic polymer roofs unsuitable for

nesting may compound the continuing problem of natural habitat loss. [Florida Game and Fresh Water Fish Commission, 551 N. Military Trail, W. Palm Beach, FL 33415, USA.]—Karl E. Miller.

43. **The status of Nelson's and Saltmarsh Sharp-tailed Sparrows on Waccasassa Bay, Levy County, Florida.** W. Post. 1998. *Florida Field Nat.* 26:1–6.—Little is known about the winter distribution of Nelson's Sharp-tailed Sparrow (*Ammodramus nelsoni*) and Saltmarsh Sharp-tailed Sparrow (*A. caudacutus*), two species formerly considered conspecific as *A. caudacutus*. The author examined 183 sharp-tailed sparrows caught in mist nets in salt marsh habitat on the Gulf Coast of northern Florida during two winters. He used a dichotomous key to plumage characters and wing and bill dimensions to identify 162 of the sparrows to species and subspecies. Nelson's (*A. nelsoni*) was by far the most common species (96% of birds examined) of sharp-tailed sparrow, and these were principally of one race, *A. n. nelsoni*. These results contrast with mist-netting results from the South Carolina coast, where Nelson's and Saltmarsh were found in roughly equal proportions. The author tentatively suggests that *A. n. nelsoni* winters chiefly on the Gulf coast, while the eastern breeding populations of the species (*A. n. alterus* and *A. n. subvirgatus*) winter mainly on the Atlantic coast. In contrast, the Saltmarsh Sharp-tailed Sparrow (*A. caudacutus*) likely winters only along the Atlantic coast, typically south of its breeding range. Further banding studies and museum work are recommended to delineate the winter ranges of the various races within the two species. [Charleston Museum, 360 Meeting St., Charleston, SC 29403, USA; e-mail: grackler@aol.com]—Karl E. Miller.

44. **Intra-specific abundance-distribution relationships.** L. A. Venier and L. Fahrig. 1998. *Oikos* 82:483–490.—In 1996, Venier and Fahrig (*Oikos* 76:564–570) found using simulation models that the amount of suitable habitat in the landscape influences the positive distribution-abundance relationship. In this paper, they indirectly test the results of their simulations on boreal forest birds in northwestern Ontario. They found that 16 of 20 species exhibited an intra-specific relationship between distribution and abundance. They conclude that the amount of suitable habitat in the landscape influences the intra-specific distribution-abundance relationship, and may be a reason for the positive inter-specific relationship between distribution and abundance. The authors also provide a review of the other three mechanisms that have been proposed to explain the distribution-abundance relationship (i.e., sampling artifact, ecological specialization, or metapopulation dynamics). [Landscape Analysis and Applications Section, Canadian Forest Service, 1219 Queen St. East, Sault Ste. Marie, ON P6A 5M7, Canada; e-mail: lvenier@nrca.gc.ca.]—David J. Horn.

45. **The influences of habitat, landscape structure and climate on local distribution patterns of the Nuthatch (*Sitta europaea* L.).** P. E. Bellamy, N. J. Brown, B. Enoksson, L. G. Firbank, R. J. Fuller, S. A. Hinsley and A. G. M. Schotman. 1998. *Oecologia* 115:127–136.—Bellamy et al. attempt to determine why Nuthatches are relatively rare in the southeastern portion of the United Kingdom despite the fact that they are within their historic range and the woodland within the region appears to provide suitable habitat. To address this question, the authors used field surveys and logistic regression models at multiple scales including: habitat quality of individual woods, landscape structure at both local and regional scales, and climatic conditions. They concluded that although suitable woodlands were present in the area, the habitat was too isolated from other wooded areas both within the study area and from regions outside the area to be successfully colonized by dispersing Nuthatches on a consistent basis. The authors also discuss temporal changes in the distribution of Nuthatches. [NERC Institute of Terrestrial Ecology, Monks Wood, Abbots Ripton, Huntingdon, Cambridgeshire PE17 2LS, UK; e-mail: p.bellamy@ite.ac.uk.]—David J. Horn.

46. **The breeding birds of Rennes. [Les oiseaux nicheurs de Rennes.]** J. Le Lannic and E. Collias. 1997. *Penn Ar Bed* no. 165/166:63–71. [French].—This issue of *Penn Ar Bed* includes 14 articles devoted to aspects of urban nature, including such diverse topics as urban biodiversity, the role of gardens in supporting biodiversity, urban mammals, insects, and this article dealing with the breeding birds of Rennes. All of the articles are worthy of attention and the set of them is especially useful because of the interactions and interdependencies of birds and their physical and biotic environment. The city of Rennes in northwest France covers approximately 5000 ha and includes a great variety of habitats. The focus of this study was a 16 km square area including both urban and suburban habitats. Especially noteworthy



are the graphics illustrating this paper. A color aerial photo of the city has the  $161 \times 1$  km grid squares superimposed. These then serve as the basis for graphic analysis of species observed. A second figure graphically, and very effectively, illustrates the distribution and abundance of 67 (1) species. This is done by presenting 67 miniature representations of the study area grid with presence/absence and relative abundance (number of encounters) indicated by color coding the grid squares. The species are arranged within the figure from the most abundant and widespread (e.g., House Sparrow, *Passer domesticus*; European Starling, *Sturnus vulgaris*; Swift, *Apus apus*) to those rarely encountered (e.g., Eurasian Tree Sparrow, *Passer montanus*; Reed Bunting, *Emberiza schoeniclas*; Crested Tit, *Parus cristatus*). [No author addresses given.]—Jerome A. Jackson.

## SYSTEMATICS AND PALEONTOLOGY

(see 46)

## EVOLUTION AND GENETICS

(see 7, 22, 37, 47)

## PHYSIOLOGY AND DEVELOPMENT

(see also 15, 19)

47. **Cluttered habitats reduce wing asymmetry and increase flight performance in European Starlings.** J. P. Swaddle and M. S. Witter. 1998. Behav. Ecol. Sociobiol. 42:281–287.—Fluctuating asymmetry, a measure of the asymmetry between left and right constituents of a bilaterally symmetrical organism, can serve as a measure of developmental stability. Fluctuating asymmetry may result from either genetic or environmental components which upset the developmental process. In this study, the authors manipulated the habitat of 36 captive European Starlings (*Sturnus vulgaris*) during their molt to increase their flight demand by exposing them to either cluttered or open habitats. The idea is that starlings forced to occupy the more demanding cluttered environment (versus open treatments) may decrease their primary flight feather asymmetry to reduce flight costs. By doing so the authors should obtain some notion of the relationship between fluctuating asymmetry and biomechanical performance. Starlings in open habitats did not differ in their mean asymmetry before and after molt; conversely, the primary feathers of birds in cluttered aviaries showed a significant decrease in asymmetry after the molt. With regard to flight performance, birds in cluttered treatments had greater take-off speeds and aerial maneuverability than birds in open habitats. The authors purport that these results represent the first empirical evidence to demonstrate that organisms can reduce their asymmetry in response to changes in the environment. In doing so, such organisms seemingly reduce their developmental instability and enhance components of their individual fitness. [Dept. of Ecology and Evolution, Univ. of Chicago, 1101 East 57th St., Chicago, IL 60637, USA; e-mail: gbza86@udef.gla.ac.uk.]—Danny J. Ingold.

## PLUMAGES AND MOLT

(see 47)

## WILDLIFE MANAGEMENT AND ENVIRONMENTAL QUALITY

(see also 10, 24, 25, 26, 28, 30, 42, 43)

48. **Conservation of the Noisy Scrub-bird: a review of 35 years of research and management.** A. Danks. Pacific Conservation Biology 3:341–349.—The Noisy Scrub-bird (*Atrichornis clamosus*) is a semi-flightless, insectivorous, thicket-dwelling species, for which no confirmed records existed for the 20th Century until a small, relic population was discovered in 1961, in a 300 ha patch on Mt. Gardner in Two Peoples Bay, Western Australia. The author reports on Noisy Scrub-bird biology, the conservation program since 1961, and cur-

rent management directions. In the 19th Century Noisy Scrub-birds were found in three separate areas of Western Australia, but declined to extinction in all but the Two People's Bay area, probably due to habitat alteration resulting from changes in fire regime introduced by Europeans, and by drainage of swamps. Noisy Scrub-birds are sexually dimorphic, with males holding territories and females laying a single egg and raising the young alone. Initial conservation efforts focused on habitat preservation, and included the establishment of the Two People's Bay Nature Reserve, currently with nearly 5000 ha of prime scrub-bird habitat. Protecting habitat from fire is a primary concern. A captive breeding program was only marginally successful, and translocation to other areas has involved captured birds. In recent translocation projects males have been released first and females released only after males had established territories. Since 1983, 126 scrub-birds have been translocated, with 4 of 5 translocations within 30 km of Two People's Bay successful in establishing breeding populations. Currently 7 sub-populations are identified (two were established by natural dispersal following habitat management). The area occupied by scrub-birds has risen from 300 to about 4300 ha. One translocation population (Mt Manypeaks) currently has nearly half of the entire scrub-bird population, with over 200 singing males. Corridors of vegetation linking the various sub-populations is part of the management strategy at the regional scale to provide for genetic exchange between populations of this near-flightless species, and will necessitate the cooperation of private landowners. The Noisy Scrub-bird provides an example of how biodiversity can benefit from habitat protection for a single "flagship" species. The Noisy Scrub-bird shares its habitat with several other threatened avian species including the Western Bristlebird (*Dasyornis longirostris*), and one marsupial was rediscovered at Two People's Bay that had not been recorded in over a century. People interested in conservation biology and wildlife management will want to read this paper. [Dept. of Conservation and Land Management, Two Peoples Bay Nature Reserve, RMB 8609, via Albany, WA, Australia.]—William E. Davis, Jr.

49. **Status and management of the Palila, an endangered Hawaiian honeycreeper, 1987–1996.** T. K. Pratt, P. C. Banko, S. G. Fancy, G. D. Lindsey, and J. D. Jacobi. 1997. *Pacific Conservation Biology* 3:330–340.—The Palila (*Loxioides bailleui*) is the only remaining Hawaiian bird species that requires dry forest and is found only in 13,000 ha of mamane-naio woodland on the slopes of Mauna Kea on the island of Hawaii. This paper reports on research and restoration of this Federally endangered species. The authors monitored >200 nests to learn about the breeding biology of the Palila, and banded chicks and took blood samples for genetic analyses. Palila are monogamous but do not defend territories, forage over a 3 km<sup>2</sup> range, and males (which are nearly twice as common as females) may become helpers at a nest. Hatching failure is unusually high and the long (25 d) nestling period may exacerbate predation, especially by feral cats. Palila are dependent on mamane (*Sophora chrysophylla*) seeds and the availability of seeds may limit Palila productivity. In 1992, a drought year with low mamane seed production, the number of nests decreased by >90%. The Palila Recovery Plan emphasized enhancement of the mamane woodland by removal of feral sheep and goats, with the hope of doubling the Palila population. The removal of sheep and goats has led to regeneration of mamane, particularly at higher elevations, but also to the growth of grasses at mid-elevations, which pose a fire threat and suppress mamane regeneration. The state has initiated a predator control program aimed at rats and feral cats. Reintroduction of Palila to areas of regenerating mamane habitat are planned. The complexities of a recovery plan that emphasizes habitat alteration are exemplified in this paper. The removal of sheep and goats generated negative reaction from people who wished to hunt the animals, and the fire threat from increased fuel load following the removal of the ungulates is a major problem. This is a fascinating story with lots of public relations and ecological problems. [Pacific Island Ecosystems Research Center, Biological Resources Division, U.S. Geological Survey, P.O. Box 44, Hawaii National Park, HI 96718, USA.]—William E. Davis, Jr.

50. **Conservation of the endangered Gould's Petrel (*Pterodroma leucoptera leucoptera*).** D. Priddel, and N. Carlile. 1997. *Pacific Conservation Biology* 3:322–329.—Gould's Petrel is the rarest endemic Australian seabird and is Federally endangered. They breed on a single island, Cabbage Tree Island, near Port Stephens, New South Wales. The number of birds on the island was estimated as about 2000 in 1970, and about 1500 in 1992. Between 1989 and

1993 the breeding success (proportion of eggs that produced fledged young) was estimated at about 20%. Adult mortality was high and adult and nestling mortality were principally caused by entanglement in the fallen sticky fruits of the birdlime tree (*Pisonia umbellifera*), and by predation by Pied Currawongs (*Strepera graculina*) and Australian Ravens (*Corvus coronoides*). The population was in decline. Experimental management began in the breeding season of 1992–1993 with the destruction of currawong nests and young and herbicide applications to birdlime trees in petrel nesting habitat. The following season culling adult currawongs and ravens began. In the 1992–1993 season the deaths of 43 of 52 Gould's Petrels found dead were attributed to predation by currawongs and ravens, but only 7 during the three seasons following predator control. The average number of breeding pairs increased from a pre-management 166 pairs to post-treatment 335. Breeding success for the 1993–1994 season increased to about 45% and to 59% the following year. Breeding success dropped to 26% in 1995–1996 following a high instance of egg abandonment that correlated with a regional die-off of pilchards and with a similar high egg-abandonment by Little Penguins (*Eudyptula minor*), suggesting a catastrophic change in the marine environment with resultant negative impact on seabirds. Although the authors could not exclude the possibility of oceanographic perturbations as causal agents, the data strongly suggest that the decreased adult mortality, increase in numbers of nesting pairs, and increased breeding success of Gould's Petrels were related to the management practices begun in 1992–1993. This suggests an optimistic view for the recovery of this endangered species. This paper should be of interest to those concerned with the conservation of seabirds. [NSW National Parks and Wildlife Service, P.O. Box 1967, Hurstville, NSW 2220, Australia.]—William E. Davis, Jr.

#### BOOKS AND MONOGRAPHS

51. **The Birds of St. Lucia, West Indies.** Allan R. Keith. 1997. British Ornithologists' Union, by Henry Ling Ltd. At the Dorset Press, Dorchester, Dorset, England. 176 pp., hardbound. This is checklist #15 in the British Ornithologists' Union (BOU) series, and lives up to the excellent standard this series has previously set. Meticulously researched and very complete, this is a major step in the direction of understanding the avifauna of the Lesser Antilles. The lengthy introductory section covers the island's history (political and ornithological), geography, climate, and conservation and discusses migration and breeding species here. The meat of the work is the systematic list in the next section, followed by various appendices including specimen locations, banded bird recoveries, expanded information for St. Lucian endemics and a discussion on origins of Antillean species. Most of the introduction is of interest mainly to those who will be visiting, but the ornithological history is an interesting chronology of the development of the current list. The section on migration is applicable to the entire Lesser Antilles, not just St. Lucia. The systematic list is also very detailed, and will be of value to anyone interested in the West Indies. For each species, both its world or North American range and its West Indies range are given as well as its status in St. Lucia along with specimen information. This combination of range information really gives the reader a more complete understanding of each species' status than most similar checklists. One very minor irritant was that the abundance terms used in this book are not defined until the systematic list but are used throughout the preceding sections, so whenever the reader wants to understand a particular term it is necessary to forward to the list for the definition.

While most of the information in this book is specifically applicable to St. Lucia, there is enough in here for students of any island in the Lesser Antilles to recommend it. For those interested in studying St. Lucia or travelling there, this book is absolutely mandatory.—Giff Beaton.