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RECENT LITERATURE

Edited by Robert C. Beason

RESEARCH TECHNIQUES

(see also 31, 32)

1. Within-season variation in nest numbers of Double-crested Cormorants (*Phalacrocorax auritus*) on the Great Lakes: implications for censusing. P. J. Ewins, D. V. Weseloh, and H. Blokpoel. 1995. Colon. Waterbirds 18:179–192.—Double-crested Cormorants have experienced a rapid population increase in the past few decades (recently nearly 30%/year) and are increasingly in conflict with commercial and sport fishermen. Thus it is important to gain a fuller understanding of the breeding chronology and reproductive success of this species. The authors examined available data on breeding chronology and compared census counts of nesting cormorants at different stages of the breeding cycle at >40 colonies in Lakes Superior, Huron, and Ontario. The census unit was the "Apparently Occupied Nest" (AON) which included any aggregation of sticks or other nesting material constructed during that breeding season whether or not it held eggs or young. Two counts were made at each colony, an early count during mid-incubation phase and a late count 3–5 weeks later during the mid-nestling period. The later counts averaged 22% higher for Lake Superior and Huron colonies, and 74% higher for Lake Ontario. The time of nesting was about two weeks later in the upper Great Lakes, and later in newly established colonies. The authors suggest that both differences in timing of nest initiation and stage of nesting must be taken into consideration when censusing and that consistent and repeatable census techniques should be employed. They also suggest that until the breeding biology of the Great Lakes cormorants is more fully understood counts of AONs will remain but an index of trends in cormorant breeding numbers and may underestimate the actual breeding population. This study raises some important issues about census procedures, and should be of interest to anyone concerned with census techniques or colonially nesting birds. [Canadian Wildlife Service-Ontario region, Environment Canada, 4905 Dufferin St., Downsview, Ontario M3H 5T4, Canada.]—William E. Davis, Jr.

BEHAVIOR

(see also 11, 13, 15, 18, 20, 21, 22, 23, 24, 38)

2. Female choice for complex song in the European Starling: a field experiment. D. J. Mountjoy and R. E. Lemon. 1996. Behav. Ecol. Sociobiol. 38:65–71.—The authors studied European Starlings (*Sturnus vulgaris*) at a group of 40 nest boxes in Quebec, Canada, in order to test the hypothesis that females use the long, complex songs of male starlings as a way to assess male condition versus the quality of nest sites. In order to determine whether certain nest sites were preferred over others, all starlings were removed from the experimental nest boxes after the onset of nesting, and a second group of starlings were allowed to move in. Settlement patterns in both groups were consistent suggesting that there were definite preferences for certain nest sites; however, the most preferred sites were not generally occupied by males with the most complex song repertoires. On the other hand, females chose males with more complex songs, and this relationship remained unaltered even when controlling for nest-site preference variables. This suggests that females were not selecting males on the basis of certain nest-site characteristics they controlled. Moreover, when several male morphological traits were controlled for, the relationship between male song complexity and the time it took for females to initiate egg laying, remained constant. These data also suggest that females were actually assessing male song directly. A significant positive correlation between song repertoire size and male body condition (weight regressed against tarsus) also suggests that males with the greatest song repertoire were in the best condition. Thus, the authors conclude that the evolution of complex song in male starlings is likely the result of female sexual selection, in which age and condition were revealed by song repertoire size. [Dept. of Psychology, Burnett Hall, Univ. of Nebraska–Lincoln, Lincoln, NE 68588-0308, USA.]—Danny J. Ingold.

3. Dominance and survival of Dippers (*Cinclus cinclus*). D. M. Bryant and A. V. Newton.

1996. Behav. Ecol. Sociobiol. 38:173–181.—Since among many bird species, site residency and familiarity of an area have a significant effect on dominance, assessments of dominance are perhaps most accurate in neutral settings. In order to separate dominance from site-related factors in Dippers, the authors conducted 27 dominance assessment experiments involving 131 wild birds over three years in a laboratory setting. Specifically the authors wanted to determine how dominance status in Dippers is related to sex, age, song, and body size, and whether dominance status assessed in the laboratory is related to survival in the wild. Dominance status was related to both age and sex. Adult males were dominant over all other age/sex classes winning 80% of their trials. Adult males also sang significantly more than females and juveniles. Adult females were dominant over juvenile males which in turn were dominant over juvenile females. Relatively few correlations between body mass or size and dominance were detected; for example, although female Dippers are smaller than males, they were indeed dominant over younger males. This strengthens the important role that sex/age differences play in this species in determining dominance relationships. Logistic regression analyses revealed that the effect of dominance (determined in the laboratory) on survival was negative for juvenile males, lacking in adult males and juvenile females, and approaching significance in adult females. When the data for juvenile males and adult females were combined, significant effects of dominance on both overwinter and annual survival were detected. No other factors including song frequency, body mass, and head plus bill size were found to be significantly related to subsequent survival. These data led the authors to conclude that dominance may have no effect on survival in Dippers or a negative effect on adult females and juvenile males, which is related to their intermediate status. Moreover, since the dominance effects on survival in this study may have been confounded by habitat quality (dominance might only facilitate territorial acquisition, and the latter may actually be the more important factor in influencing survival) the authors suggest that further experimentation is necessary, and they discuss some possible approaches to accomplish this. [Dept. of Biological and Molecular Sciences, Univ. of Stirling, Stirling FK9 4LA, UK.]—Danny J. Ingold.

4. Aggressive behaviour of Red Wattlebirds *Anthochaera carunculata* and Noisy Friarbirds *Philemon corniculatus*. H. A. Ford and S. Debus. 1994. Corella 18:141–147.—The authors present the first long-term quantitative assessment of aggression in two large honeyeaters in New South Wales, Australia. Time budgets for Red Wattlebirds (*Anthochaera carunculata*) and Noisy Friarbirds (*Philemon corniculatus*) suggest that both species spend less than 2% of their time in aggressive interactions, including chases, displacements, and actual fights. Aggression rates were lower around nests than elsewhere. In a flowering *Grevillea* wattlebirds had lower rates of aggression than in woodlands, while friarbirds had higher rates. Friarbirds chased wattlebirds twice as frequently as the reverse at the *Grevillea,* but wattlebirds may be the more aggressive species at nest sites. In this study 33 species of birds were chased by friarbirds (25 species) or wattlebirds (26) whereas only 6 species were aggressive towards wattlebirds and 9 towards friarbirds. For wattlebirds 24% of aggressive interactions were intraspecific, for friarbirds 37%. The authors conclude that neither Red Wattlebirds nor Noisy Friarbirds are as persistently aggressive as the largely anecdotal literature would suggest, and that most interspecific aggression is towards other large honeyeaters or potential nest predators. They also suggest, however, that the aggression of these two species may have significant effects on nesting success of other species when birds are concentrated in small forest remnants. [Dept. of Zoology, Univ. of New England, Armidale, NSW 2351, Australia.]—William E. Davis, Jr.

5. Life in extreme dryness and heat: a telemetric study of the behaviour of the Diamond Dove *Geopelia cuneata* in its natural habitat. E. Schleucher. 1993. Emu 93:252–258.—Many physiological studies have been done on Diamond Dove (*Geopelia cuneata*) heat tolerance. However, little field work has been done to correlate lab data with behavior. Using radio transmitters attached to the tails of four Diamond Doves, Schleucher located and observed flocks of the doves. Ambient temperature was taken each day for 30 days using a thermohygrograph. The microclimate temperature for the birds was monitored by a thermosensor on the radio transmitter, and verified by a second temperature reading made manually after the birds flew away. The results showed the Diamond Doves' microclimate

was at a consistently higher temperature than the ambient temperature. Diamond Doves showed no marked drop in activity as was found in raptors and Zebra Finches (*Taeniopygia guttata*). Further, Diamond Doves showed no signs of heat stress while active at temperatures ranging from 43–65 C, while Zebra Finches at rest panted and spread their wings. Diamond Dove heat tolerance allows them occupation of a temporal niche which Zebra Finches can't occupy. The study shows that raptors are not active in this same temporal niche. However, no numbers were provided to indicate how many raptor sightings allowed these conclusions to be drawn. As raptors are typically solitary birds, low sample size may be a problem in estimating activity levels, especially during only a 30 day study. Even if the raptor data are inadequate, lack of competition by the finches indicates temporal niches need not be as simple as night and day.—Stephen E. T. Kacir.

6. Differential responses of territorial Tawny Owl (*Strix aluco*) to the hooting of neighbors and strangers. P. Galeotti and G. Pavan. 1993. Ibis 135:300–304.—Field playback experiments were made in Pavia, Italy to compare the abilities of Tawny Owls to discriminate between hooting calls made by neighbors and strangers, and determine if they calibrate the intensity of their response based on the discrimination. Twelve pairs of owls were tested using recordings of neighbor and stranger male hoots collected the year before. The recordings were directed to the center of the territory of the pair under study and their responses recorded. Eight of the twelve pairs of owls studied responded. The results indicate a significantly greater aggressiveness in response from both members of the pair towards stranger's hoots than towards those of neighbors, but the intensity of aggressive response to strangers decreased with repeated playback. These findings support previous studies suggesting that Tawny Owls learn to recognize the hoots of neighbor owls, and react more quickly and more aggressively to strangers. Repeated hoots from strangers decrease the intensity of response of the pairs under study, as the strangers cease to be a threat and the owls habituate to the new call. The results provide evidence for excellent memory in Tawny Owls, and ability to discriminate between individual owls.—Maria Luisa Sanchez.

7. Courtship feeding in Ospreys *Pandion haliaetus*: a criterion for mate assessment? D. A. Green and E. A. Krebs. 1996. Ibis 137:35–43.—Before egg-laying, female Ospreys will accept food given by their mates which is a behavior that may be associated with one or more of the following: female assessment of future male parental performance, trade of copulation for food, determination of whether females are ready or willing to breed, or the timing of egg laying. Green and Krebs observed Ospreys in British Columbia during the breeding seasons of 1991 and 1992. Only 63 of the 385 observed copulations were associated with feedings. Therefore, increased likelihood of copulation was not associated with food delivery. The rate of courtship feeding in pairs that laid eggs was significantly higher than in pairs that did not lay eggs. Females who successfully initiated a clutch were fed at a higher rate than those who failed. The rate of prey delivery to the nest by the male when chicks were 1–2 weeks old was correlated positively with the rate of courtship feeding. Therefore, there is a possibility that female Ospreys can use rates of courtship feeding as an indication of male parental performance. Hatching asynchrony was less in pairs where the male provisioning rate was high. Females can use courtship feeding rates as a guide to evaluate a mate's parental performance and adjust hatching asynchrony accordingly. This behavioral study is important in interpreting possible causes of variation of hatching asynchrony in Ospreys.—Michelle Duncan.

FOOD AND FEEDING

(see also 14, 24, 35)

8. Food of the Capercaillie *Tetrao urogallus* in the Black Forest. [Zur Nahrungswahl des Auerhuhns *Tetrao urogallus* im Schwarzwald.] M. Lieser. 1996. Ornithol. Beob. 93:47–58. (German, English summary.)—From 1990–1994 124 fecal samples of adult Capercaillie were analyzed to determine seasonal variation in diet. In winter, 90% of the diet was conifer needles, especially Norway spruce (*Picea abies*) with Scotch pine (*Pinus sylvestris*) and silver fir (*Abies alba*) of lesser importance. In April there was a rapid shift to the buds and young leaves of beech (*Fragus sylvatica*) which comprised 68% of the diet by May. During the

summer and early autumn herbs (63% in July), grasses (33% in Sept. and Oct.), and berries (20% in July and August) were the most important foods. Consumption of larch (*Larix decidua*) needles peaked at 47% in August. Animal matter was not important at any time of the year. Capercaillie habitat can be encouraged through selecting specific tree species and intensive thinning of young stands. [Forstzoologisches Institut der Universitätt Freiburg, Fohrenbühl 27, D-79252 Stegen-Wittental, Switzerland.]—Robert C. Beason.

9. Foraging site preference of Intermediate Egrets *Egretta intermedia* during the breeding season in the eastern part of the Kanto Plain, Japan. N. Sato and N. Maruyama. 1996. J. Yamashina Inst. Ornithol. 28:19–34.—Between June and August 1993, the authors censused Intermediate Herons from levees at preselected sites in two areas of central Honshu. Most sites were rice or lotus fields or along rivers. Intermediate herons avoided rivers, dry fields, and flooded fields with deep concrete waterways. They used flooded young rice and lotus fields most, but also some in temporarily flooded grassy areas near rivers. In July and August fields with taller, dense vegetation were used less. Data are also presented on prey taxa and size taken: fish, crayfish, amphibians, insects (especially dragonflies and grasshoppers). In rice and lotus fields at one area in June, fish (mainly loaches, Cobitidae) represented about 90% of the prey biomass. By July, the biomass of fish taken was only about 30% of the diet. Habitat changes associated with land consolidation (more concrete waterways, fewer prey) are predicted to result in lower heron populations. [Dept. of Eco Region, Faculty of Agriculture, Tokyo Noko University, 3-5-8 Saiwaicho, Fuchu, Tokyo, 183 Japan.]—Jerome A. Jackson.

10. Prey analysis of the Buzzard, *Buteo buteo* (Accipitridae), in the Waldviertal region (Lower Austria). [Zum Beutespektrum des Mausebussards, *Buteo buteo* (Accipitridae), im Waldviertal (Niederosterreich).] W. Haberl. 1995. Egretta 38:124–129. [German, English summary.]—Regurgitated pellets suggest that the diet of *Buteo buteo* in Schonbach is dominated by *Microtus* spp. (76.7%) with other rodents comprising 5.5%, shrews and moles 8.4%, rabbits 0.5%, birds 0.5%, and the lizard *Lacerta vivipara* a substantial 8.4%. In the discussion the author considers relative abundance (qualitative, not quantitative) and daily activity cycles of prey species. [Hamburgerstrasse 11/17, A-1050 Vienna, Austria.]—Jerome A. Jackson.

11. Vicarious sampling: the use of personal and public information by starlings foraging in a simple patchy environment. J. J. Templeton and L. Giraldeau. 1996. Behav. Ecol. Sociobiol. 38:105–114.—Most patch departure research on birds has focused on solitary foragers and the information they acquire alone (personal information) as the overriding influence which determines how long they will remain in a food patch. Social or group-foraging birds may have an advantage over solitary foragers in that it is possible for individuals in a flock to make foraging decisions based on the information they acquire from observing the foraging activities of other birds in the same patch (public information). The authors, in a previous study, found evidence that European Starlings (*Sturnus vulgaris*) used both personal and public information to gauge when to leave a patch; however, food in the study was always present, and public information regarding patch quality in terms of feeding success was available. In the present study, the authors conducted a series of laboratory experiments with wild starlings to determine whether group-foraging individuals are able to use the unsuccessful foraging activities of neighboring conspecifics as a supplementary source of information to assist them in determining patch quality and when to depart from patches. Experimental birds were allowed to forage with partners that were trained to sample only a few food-containing holes (low-information partners) and partners that were trained to sample numerous food-containing holes (high-information partners). If starlings use public information to determine patch quality, the authors predicted they would sample fewer holes before departure when with a low-information partner than when alone, and even fewer holes when with a high-information partner. Prior to testing foraging birds in pairs, experimental starlings were allowed to forage in a solitary arena (each subject received 100 trials). By the last 20 trials, significantly fewer potential food holes were sampled on empty patches than on food patches, and the birds' mean intake rates were found to be close to that achieved by a perfectly rate-maximizing forager. This suggests that starlings were able to use personal information from their unsuccessful foraging activities in a rate-maximizing fashion to assess the patch quality of a two-patch system. In the first paired-sampling experiment, the

authors detected no evidence for the use of public information to help experimental birds assess patch quality. The authors suggest that this lack of vicarious sampling may have occurred for two reasons: (1) it was simply too difficult for starlings to sample the patch and watch their partner simultaneously, and (2) the linear array of holes allowed experimental birds to sample the patch in a methodical, systematic manner, making it easy for them to acquire personal information about patch quality. Thus, public information may not have been necessary or useful. The authors then modified the foraging patches and conducted a second paired-sampling experiment that made it easier for an individual to watch a partner bird and more difficult to acquire accurate personal sampling information. This time they found that subject birds used public information, sampling significantly fewer holes before departure from the empty test patch when with the high-information partner than when alone. They also sampled significantly fewer holes when with a high-information partner than with a low-information partner, and had significantly lower probing rates when with partners than when alone. These data suggest that indeed starlings in this experiment not only paid attention to foraging partners, but they obtained useful information from them and responded appropriately to the public information they received. The authors conclude by suggesting that the degree to which public and personal information are used by foraging birds depends on an individual's ability to retain personal information about patch quality and how easy it is for birds to forage and observe other foraging birds at the same time. [School of Biological Sciences, Univ. of Nebraska, Lincoln, NE 68588-0118, USA.]—Danny J. Ingold.

12. **Responses by four seabird species to a fluctuating availability of Cape Anchovy *Engraulis capensis* off South Africa.** R. J. M. Crawford and B. M. Dryer. 1995. Ibis 137:329–339.—For the African Penguin (*Spheniscus demersus*), Cape Gannet (*Morus capensis*), Cape Cormorant (*Phalacrocorax capensis*), and Swift Tern (*Sterna bergii*), the Cape anchovy is a major component of the diet. From 1984 to 1992, changes in the behavior of the four species of seabirds were related to the biomass of spawning anchovy which varied from 0.5 million tonnes in 1990 to 1.75 in 1986. The variables studied included diet, population trends, seasonal patterns of breeding, desertion of nests, chicks fledged and recruitment of immatures. Statistically significant changes in three population dynamics variables were found in connection with low abundance: lowered number of African Penguin chicks fledged, fewer Cape Cormorants and Swift Terns breeding, and more abandoned nests and deferred breeding in African Penguins and Cape Cormorants. The researchers used binoculars to see what prey the tern carried in its beak for an estimate of the diet of the Swift Tern. This technique is subject to error in numbers as well as in distinguishing the type of prey. A second problem is the assumption that the colonies are discrete. This speculation could lead to a false count of nests abandoned. Crawford and Dryer found, however, there were similar responses by numerous related species of seabirds when the availability of prey changed.—Mary E. Koch.

SONGS AND VOCALIZATIONS

(see also 2, 6)

13. **The dawn chorus in a eucalypt forest bird community, seasonal shifts in timing and contribution of individual species.** A. Keast. 1994. Corella 18:133–140.—In this paper the author presents a quantitative assessment of dawn chorus structure in an eastern Australian bird community. He considers the initial time and duration, seasonality, and species which contribute to the chorus. Sound output for each species was quantified by counting the number of songs per unit time and determining the length of songs from sonagrams. The sound output of the community was calculated for five-minute intervals pre- and post-dawn by summing individual species data. These data are presented in a series of histograms showing how total sound relative to sunrise changed seasonally. Twenty-three species contributed to the chorus, which was primarily a spring, pre-dawn phenomenon, with peaks in August when courtship activity was high, October with the return of migrants and second brood initiation by residents, and December post-breeding. A second figure details sound production by season for individual species. The dominant singing species changed seasonally, often with reduced sound while young were present. Seasonal patterns in time of first vocalization for major contributing species is presented graphically. Rain delayed the start of the dawn

chorus and reduced the total sound output. This is an interesting attempt to quantify sound production in an avian community, and should be of interest to any student of bird vocalization. [Dept. of Biology, Queen's Univ., Kingston, Ontario K7L 3N6, Canada.]–William E. Davis, Jr.

14. Diel temporal vocalization patterns in the Mistletoebird (*Dicaeum hirundinaceum*) and seasonal abundance relative to the flowering and fruiting of the mistletoe *Dendrophthoe vitellina*. A. Keast. 1995. Corella 19:2–7.—The author confirms that seasonal movements of the Mistletoebird *Dicaeum hirundinaceum* are related to the abundance of flowering and fruiting mistletoe in New South Wales, Australia. Mistletoebird song output was quantified by multiplying the number of songs per minute by the length of songs as determined from sonagrams. Song output data were standardized relative to sunrise and presented graphically by season. Singing began about 15 minutes before sunrise and continued for about two hours, after which it diminished significantly. Census data suggest that a small resident population is supplemented by a 7–10-fold influx of birds in late November to early December when the dominant mistletoe species was flowering. This influx was accompanied by a significant increase in total song production. A decrease in song and mistletoebird numbers occurred by late December when the mistletoe berry crop has been largely harvested. Drought in 1991 and 1993 led to a substantial reduction in mistletoe flowering and fruiting which correlated with diminished mistletoebird numbers and song. Vocalizations of most other bird species in the area peak before dawn, hence Mistletoebirds are atypical. They have a territorial association with mistletoe plants and song may have a courtship and/or territorial function. [Dept. of Biology, Queen's Univ., Kingston, Ontario K7L 3N6, Canada.]—William E. Davis, Jr.

15. Vocal communication in Peregrine Falcons *Falco peregrinus* during breeding. P. Carlier. 1995. Ibis 137:582–585.—The distinctive vocalizations of Scottish peregrines, in Quercy, France, were quantified during courtship, incubation, and chick-rearing. The long and continuous wailing calls, *eeyaik-eeyaik, waaik, yee-errk yee-errk,* and *ghiii-ghiii-ghiii,* were equally common among courting males and females. The number of short, sharp creaking calls, *kleechip, kleechup, eechip, iitchep,* and *iiitsick,* was greatest after the start of incubation. They were given more frequently by males than females, and commonly occurred prior to feeding by the male. By labelling the creaking call as a "food-begging call" Carlier draws an inadmissible functional conclusion. Although the creaking call was uttered significantly more frequently by males prior to feeding than not (Walsh test, $n = 5$, $P < 0.03$), Carlier contradicts his previous significant finding that "the use of both creaking and wailing calls was less frequently associated with a bird (of either sex) bringing in food than with all other situations involving no food (Walsh test; creaking call: $n = 6$, $P < 0.03$; wailing call: $P < 0.02$)." Since a consistent correlation between the creaking call and food transfer has not been established, the problem exceeds mere semantics in that "creaking" describes this call objectively while "food-begging" suggests its particular function subjectively.—A. Joseph Marfori.

NESTING AND REPRODUCTION

(see also 2, 7, 15, 33)

16. Breeding seabirds of the Houtman Abrolhos, Western Australia: 1991–1993. P. J. Fuller, A. A. Burbidge, and R. Owens. 1994. Corella 18:97–113.—In this paper the authors report on three years of census data of seabirds breeding on 122 islands, islets, and rocks within the Houtman Abrolhos archipelago. The birds discussed include egrets, sea-eagles, oystercatchers, and cormorants in addition to the more traditional "seabirds" such as gulls, terns, shearwaters, and storm-petrels. The Houtman Abrolhos is one of the most important seabird breeding sites in Australia and has the largest concentrations of breeding birds in the eastern Indian Ocean for 10 species, e.g., Wedge-tailed Shearwaters (*Puffinus pacificus*): 1,117,800 pairs. The fauna includes both tropical and warm temperature species. In this very thorough and well-structured report, appendices report results by both island and bird species, and a map shows the location of the major island groups and key islands and reefs. A text summary is presented for 21 species that for most species includes: total breeding pairs, number of islands where present, nesting situation (e.g., colonial), nest description (e.g.,

burrow), arrival and departure dates, and comparisons of Houtman Abrolhos populations with other breeding sites in the eastern Indian Ocean. This is the first comprehensive report on the breeding birds of this archipelago and represents important baseline data. Although there are currently few significant threats to seabirds and the islands are managed to produce minimal disturbance, the authors suggest that reserving important islands as a national park would be desirable. They point out that future threats include oil spills, depletion of marine resources by human exploitation, sea level rises, and introduction of mammalian predators. [Dept. of Conservation and Land Management, Western Australian Wildlife Research Centre, P.O. Box 51, Wanneroo, WA 6065, Australia.]—William E. Davis, Jr.

17. Colony effects on fledging success of Great Blue Herons (*Ardea herodias*) in British Columbia. R. W. Butler, P. E. Whitehead, A. M. Breault, and I. E. Moul. 1995. Colon. Waterbirds 18:159–165.—The authors describe the distribution and fledging success of 31 Great Blue Heron colonies in the Strait of Georgia between 1987 and 1992. The number of pairs/colony ranged from 1–387, with 3 colonies with >150 pairs comprising nearly half of the total nests. Mean fledging success was 1.7 fledglings/nesting attempt and longevity of colonies was correlated positively with fledging success. Declining fledging success correlated with colony abandonment. Most large broods were in small colonies, but the probability of nest failure was greater. In this study the criteria for an occupied nest included the continued presence of adult birds, and/or the presence of fecal material and broken eggs or dead chicks under the nest. The authors point out that nesting failure accounts for a large part of the variation in fledging success calculations, and that studies that use only data from nests with fledglings tend to overestimate fledgling success. Number of nesting pairs and fledging success at colonies were highly variable among years and hence, short-term studies may be inadequate to properly assess the productivity of a colony or group of colonies. Changes from year to year in the numbers of breeding pairs suggest substantial interchange among colonies, some of which may be related to human and Bald Eagle (*Haliaetus leucocephalus*) disturbance. [Pacific Wildlife Research Centre, Canadian Wildlife Service, 5421 Robertson Road, RR1, Delta, B.C. V4K 3N2, Canada.]—William E. Davis, Jr.

18. Adult aggressiveness and crèching behavior in the Greater Flamingo, *Phoenicopterus ruber roseus*. C. Tourenq, A. R. Johnson, and A. Gallo. 1995. Colon. Waterbirds 18:216–221.—Although crèche behavior has been reported in the five species of flamingos crèche formation and its proximate causes have not been studied in detail. The authors report on a 1992 study of the Greater Flamingo at an artificial island breeding colony in the Camargue, France. Aggressiveness by 219 adult flamingos (accompanying their chicks) was quantified (number of bill strokes against a conspecific/15 minutes) using a "focal-animal" sampling method. Chicks, were classified by age class as "after-hatch," "standing," "walking," "explorer," "neglected," and "crèching." Parental aggressiveness was at its highest during the walking and exploring stages, and lowest when the chicks reached the crèching stage. When chicks wandered by attended nests they were attacked and eventually joined other chicks at "safe" places where there were smaller numbers of aggressive adults. They thus formed small crèches at which accompanying adults acted less aggressively. These small crèches tended to coalesce temporarily into larger ones during disturbance, e.g., attacks by Yellow-legged Gulls (*Larus cachinnans*). Eventually all 3200 chicks joined into a single "unique" crèche which was stable. The authors conclude that adult aggression levels contribute to the development of chick crèching behavior. [Station Biologique de la Tour du Valat, Le Sambuc, 13200 Arles, France.]—William E. Davis, Jr.

19. Interior Least Tern site fidelity and dispersal. R. B. Renken and J. W. Smith. 1995. Colon. Waterbirds 18:193–198.—The authors report on a 1987–1991 study to assess population stability in Least Tern (*Sterna antillarum*) breeding colonies along a 201 km section of the Mississippi River south of Cairo, Illinois. This section of river is characterized by sand islands adjacent to dikes maintained by the U.S. Army Corps of Engineers. Specific goals included assessment of site fidelity and tern movements in and outside of the river basin. Nearly 200 adult terns and 34 (of 1674 banded) juveniles were color banded. Forty percent of adults and 1% of all chicks were resighted in a subsequent year or years. Forty-two percent of resighted birds returned to the colony of banding at least once. Hence most terns were not site-faithful to their colony, although a few were very site-faithful. However, most terns

were resighted within a few km of their natal colony, suggesting that they typically nest at several colonies along the same stretch of river. Only 1 of 19 banded chicks was later sighted at its natal colony. Two terns nested 300 km from where they were banded and two others 1000 km away. The results support the hypothesis that birds nesting in unpredictable environments will show little site fidelity. The authors suggest that the low levels of site fidelity and dispersal over significant distances by some birds may benefit other tern populations that may be experiencing decline or low productivity. This may be important for the recovery of this federally endangered subspecies. [Missouri Dept. of Conservation, 1110 S. College Ave., Columbia, MO 65201, USA.]—William E. Davis, Jr.

20. Chick recognition and acceptance: a weakness in Magpies exploited by the parasitic Great-spotted Cuckoo. M. Soler, J. Soler, J. Martinez, and A. Moller. 1995. Behav. Ecol. Sociobiol. 37:243–248.—Although it is well known that many host bird species of parasitic cuckoos are able to discriminate between their own eggs and mimetic eggs, most appear incapable of discriminating a chick that is dramatically different in appearance from their own. During three breeding seasons in southern Spain, the authors conducted a series of experiments in order to determine whether Magpies (*Pica pica*) are incapable of discriminating among their chicks and the parasitic chicks of Great-spotted Cuckoos (*Clamator glandarius*). In contrast to other parasitic cuckoos, Great-spotted Cuckoo nestlings mimic the young of the host in appearance and do not evict the eggs or nestlings of the host from the nest. Thus, they may be a stronger selection pressure among those species parasitized by Great-spotted Cuckoos (typically corvids) to learn to discriminate among their own nestlings and parasitic ones. Indeed Magpies were able to discriminate parasitic chicks to some degree and this discrimination ability increased with the age of the chicks. Magpies were particularly effective at discrimination when large, non-mimetic cuckoo chicks were introduced. Unparasitized magpies were better able to discriminate cuckoo nestlings than were parasitized magpies, which suggests that magpies learn to recognize their own nestlings as those present in the nest. This comparison apparently then serves as a basis for subsequent discrimination; however, young cuckoos do exploit the obligatory behavior of magpies to feed all of their young that have hatched in the nest. Experimental Great-spotted Cuckoo nestlings presented to magpies outside the nest were neglected significantly more often than experimental nestlings introduced in the nest. Moreover, magpies tolerated alien magpie nestlings significantly more often than cuckoo nestlings both within and outside the nest, which rejects the hypothesis that Great-spotted Cuckoo nestlings provide a supernormal stimulus to their hosts in order to avoid recognition as previously predicted by the authors. [Dept. de Biologia Animal y Ecologia. Facultad de Ciencias. Univ. de Granada. E-18071 Granada, Spain.]—Danny J. Ingold.

21. Polygyny in the Red-winged Blackbird: do females prefer monogamy or polygamy? S. Pribil and J. Picman. 1996. Behav. Ecol. Sociobiol. 38:183–190.—Five principal hypotheses have been posed to explain the existence of polygyny in the Red-winged Blackbird (*Agelaius phoeniceus*). These hypotheses may be divided into three groups based on female preferences for unmated versus monogamously mated males (three predict that when male and territorial quality are held constant, females will prefer unmated males; one predicts that females have no preference and settle randomly; another predicts that females will benefit from the presence of other females and will thus prefer monogamously mated males). The authors tested these hypotheses during two breeding seasons in Ontario, Canada by creating adjacent bachelor and polygamous territories (by removing previously established females) and then observing the subsequent settlement patterns of new females at these choice situations (CS) both early and late in the nesting season. Sixteen CSs were established early in the season (between 22 April and 5 May), and in all 16 (100%) the first new female settled on the bachelor territory. Six CSs were established late in the nesting season (between 18 May and 22 June), and on four of these (67%) the first new female settled on the bachelor territory while on two the female settled on the monogamous territory. New and resident females did not differ significantly in a variety of morphological measures including epaulet color, either early or late in the season. Since bachelor and mated territories were established randomly, the quality of bachelor males and bachelor territories was about the same as the quality of polygamous males and polygamous territories. These data suggest that when females have a

choice, male mating status is more important than either male or territorial quality, when selecting a mate. This seemed to be particularly true early in the season; the fact that 33% of females paired with monogamously mated males late in the season suggests that the net cost of polygamy may decline as the season progresses (for which the authors discuss potential reasons). The authors conclude that Red-winged Blackbirds on their study site preferred monogamy over polygamy (bigamy), and that these preferences support the "polygyny threshold," "sexy son," and "asynchronous settlement" hypotheses, but contradict the assumptions of the "cooperative female choice" and "neutral mate" hypotheses. Thus, the latter two hypotheses probably do not explain the occurrence of polygyny in this population of Red-winged Blackbirds. [Ottawa-Carleton Inst. of Biology, Dept. of Biology, Univ. of Ottawa, 30 Marie-Curie, Ottawa, Ontario K1N 6N5, Canada.]—Danny J. Ingold.

22. Two female Eastern Bluebirds with one male fledge eight. M. Oakley. 1996. Sialia 18:49–50.—The author reports an unusual occurrence during the 1995 breeding season in Lawsonville, North Carolina in which eight Eastern Bluebird (*Sialia sialis*) nestlings fledged from the same nest box. The author reports that two female bluebirds were apparently involved in rearing the nestlings (along with a single male). It is not clear though whether both female bluebirds laid eggs that comprised the initial clutch or whether both females actually fed the nestlings. All eight nestlings fledged in May, 1995. By mid-June 1995 all three bluebirds returned (the reader must assume they are the same birds since they were apparently not banded), and this time it was evident that both females contributed to a second clutch of eight eggs (two eggs were laid each day for four days). At one point during incubation, the author even reports both female bluebirds in the box at the same time. This clutch along with one of the adult females however, was preyed on, probably by a black rat snake (*Elaphe obsoleta*); the surviving female and male bluebird subsequently initiated another nesting effort in another nearby box and fledged four more offspring. The author provides no literature citations that shed light on how common this type of occurrence may be among Eastern Bluebirds. [Rt. 2, Box 126, Westfield, NC 27053, USA.]—Danny J. Ingold.

23. Adoption or infanticide: options of replacement males in the European Starling. H. G. Smith, L. Wennerberg, and T. V. Schantz. 1996. Behav. Ecol. Sociobiol. 38:191–197.—The chance that a male bird will commit infanticide is related to the degree to which his paternity is threatened and also the chance that the affected female will lay a replacement clutch, or can be replaced by another female that will produce a clutch. In this study, the authors removed male European Starlings (*Sturnus vulgaris*) from breeding pairs during various stages of the nesting cycle in southern Sweden to determine the extent to which replacement males would fill in and the threshold at which replacement males would commit infanticide versus adopting the clutch or offspring. Twenty of 25 female starlings (80%) achieved replacement males, in most instances within one day; 17 of these replacements (85%) were already mated neighbors in possession of a nearby nestbox. When females were widowed before the onset of egglaying, replacement males adopted the subsequent clutch 93% of the time (14 of 15 cases); conversely, females that were widowed during egg laying ($n = 10$), obtained replacement males that never adopted the clutch and in at least five instances, apparently destroyed the clutch (the evidence that replacement males actually committed the infanticide was circumstantial). When infanticide occurred, females initiated replacement clutches 67% of the time, and in each case the replacement male had higher paternity than in the original clutch. The amount of time it took for females to initiate a replacement clutch increased when infanticide occurred later in the egg-laying cycle. Using DNA fingerprinting, the authors determined that a sample of replacement males that adopted clutches, fathered 36 out of 43 offspring (84%), and that the sooner replacement males moved in prior to the onset of egglaying, the more likely they were to attain paternity. In five instances (20% of the time), after the removal of males during egg-laying, infanticide did not occur, nor did any male adopt the clutch. Together these findings suggest that the strategy a replacement male employs is strongly influenced by how far along in the nesting cycle a widowed female is and the chance that she will produce a replacement clutch. [Ecology Bldg., Dept. of Animal Ecology, Lund Univ., S-223 62 Lund, Sweden.]—Danny J. Ingold.

24. Prey abundance and male parental behavior in *Acrocephalus* warblers. H. Hoi, S. Kleindorfer, R. Ille, and J. Dittami. 1995. Ibis 137:490–496.—The males of five *Acrocephalus*

warbler species, which breed in the marshes around east Austria's Lake Neusiedl, vary their parental feeding contributions according to species. Hoi et al. attribute the variation to combinations of resource predictability, vegetation or prey availability, and mate density. For instance, the facultatively polygynous male Great Reed Warblers (*Acrocephalus arundinaceus*) consistently dominated areas of high insect abundance and demonstrated extremely limited parental behavior. In comparison, the habitats of monogamous male Mustached Warblers (*Acrocephalus melanopogon*) and Reed Warblers (*Acrocephalus scirpaceus*) were most commonly found in areas of low insect density. Males of these species assisted the female in raising the offspring. Only the Mustached Warbler and Marsh Warbler (*Acrocephalus palustris*) exhibited significant negative correlation between insect density and male participation during brood rearing. Since high prey density correlates with high offspring viability, males of species that inhabit these areas could be maximizing their fitness by being polygynous and raising many broods. In contrast, species that inhabit areas of low prey density which endangers offspring survival may be maximizing their fitness by being monogamous and improving brood survival. Hoi et al. propose that the correlation between prey abundance and offspring survival explains the diverging evolution of polygynous and monogamous male warblers.—A. Joseph Marfori.

25. First egg mortality in Royal Penguins through ejection from the nest by the female parent. C. C. St. Clair, J. R. Waas, R. C. St. Clair, and P. T. Boag. 1995. Anim. Behav. 50:1177–1185.—Royal Penguins, *Eudyptes schlegeli,* lay two eggs, the second four days after the first. Many first eggs are misplaced or removed. These observations effectively eliminate some hypotheses. The authors question: why Royal Penguins have both eggs? if ejection is intentional? and what effect parentage and viability have on ejection? A popular hypothesis is that the first egg is 'insurance' in case the second egg is not laid. Traditionally the "replacement of missing or defective primary offspring has been assumed to be the principle [sic] function of the smaller egg." This hypothesis potentially explains why 57% of the eggs are removed the day prior to the laying of the second egg. The reason the first egg is ejected in preference to the second, is because the second is 60% bigger and more viable. The insurance hypothesis is overwhelmingly disproven because insurance value of the first egg is low. This is supported by only having one of 137 first eggs hatch. All were maintained solely because second eggs were not laid. Therefore, the first egg "would seldom be available as insurance offspring even if they were not intentionally ejected." Another hypothesis for ejection is "infanticide if parentage differs between first egg and second egg." In order to study the parentage of the birds, the researchers tested the DNA of both the parent birds they caught, and the ejected eggs. There was "little evidence for the hypothesis that parental relatedness differed for first and second eggs and, thus, potentially contributed to ejection behaviors." This hypothesis is also disproven with the evidence that the first eggs are removed by the female, who performed 15 of the 16 ejections. The writers of this article successfully disproved the two previously mentioned hypotheses, they do feel that claiming nest-sites by placing an egg there or enhancing mate fidelity, are likely explanations that should be further explored.—Karla Creel.

MIGRATION, ORIENTATION, AND HOMING

(see also 29)

26. The migration of Bridled Terns *Sterna anaethetus* breeding in Western Australia. J. N. Dunlop and R. E. Johnstone. 1994. Corella 18:125–129.—In this paper the authors report on 5 Bridled Terns (*Sterna anaethetus*) recovered during the austral winter, of approximately 2000 banded since 1971 at two breeding colonies on islands off the Western Australian coast. The recoveries suggest that the Western Australian terns, which breed from roughly October to April, spend their winters about 4000 km north in the northwest Celebes Sea. June through August is the fishing season in this area and presumably the time of maximum marine productivity. The suggestion that the terns winter in this area is strengthened by observations from ferry and fishing boats, and oil platforms in various straits in the Lesser Sundas during May, September and October when post-breeding and return migration occurs. The available evidence suggests that the Australian Bridled Terns on their wintering grounds do not roost on shore (they prefer flotsam) and are not systematically har-

vested for food. This interesting paper emphasizes the importance of long-term banding studies. [162 Swansea St. East, East Victoria Park, WA 6101, Australia.]—William E. Davis, Jr.

HABITAT USE AND TERRITORIALITY

27. California Black Rail use of habitat in southwestern Arizona. R. E. Flores and W. R. Eddleman. 1995. J. Wildl. Manage. 59:357–363.—Little is known about habitat use among age and sex classes of California Black Rails (*Laterallus jamaicensis coturniculus*) throughout the annual cycle. The authors set out to: (1) determine if California Black Rails selected among vegetational types; (2) determine the structural components of utilized habitats, including differences in habitat use among ages and sexes and between the seasons; (3) determine if habitat structure is selected from available habitats: and (4) determine whether vegetational composition or habitat structure is a better indicator of California Black Rail habitat. Radio transmitters were used to monitor 15 adult males, 13 adult females, and 8 juvenile Black Rails. Vegetational types were delineated using 1:2000 aerial photography. Structural components of habitat were measured in the field for areas utilized by Black Rails and for random areas. Data were grouped into four seasonal categories: early nesting, late nesting, post nesting, and winter. Rails selected marsh edges dominated by bulrushes with water depths less than 2.5 cm. Previous studies using call tapes have implied that three-square bulrush (*Scirpus americanus*) is a highly important species. The authors suggest that the occurrence of this species near the shore may overestimate its value as rail habitat. This study has shown that giant bulrush (*S. californicus*) and southern cattail (*Typha domingensis*) are highly preferred by California Black Rails. During all seasons, rails selected structural components distinct from those available. Rails selected areas with high stand densities, closed overstory, shallow water, and close proximity to upland vegetation. Habitat use differed between age and sex classes for all seasons. Differences in habitat utilization between the sexes differed the most during the winter. Structural components of habitat were determined to be more important than plant species composition. In addition, water depth may also determine habitat utilization by Black Rails. When managing habitats for California Black Rails, the authors recommend maintaining shallow water (<2.5 cm) over no more than 25% of the area, and minimizing water level fluctuations, especially during the nesting season. [Dept. of Natural Resources Science, 210B Woodward Hall, Univ. of Rhode Island, Kingston, RI 02881, USA.]—Sherry Meyer.

28. Spatial analysis of Sandhill Crane nesting habitat. B. W. Baker, B. S. Cade, W. L. Mangus, and J. L. McMillen. 1995. J. Wildl. Manage. 59:752–758.—Habitat selection of nesting Greater Sandhill Cranes (*Grus canadensis tabida*) was studied at the Seney NWR, Michigan, from 1984 to 1987. The habitat surrounding nest locations was compared to the available habitat (via random points) at five different spatial scales. Telemetry was used to define the average home range size (radius = 709 m) and core area size (radius = 419 m) utilized during the breeding season. Circular buffers with radii of 50, 100, 200, 419, and 709 m were selected for habitat analysis. Habitats were mapped from 1:12,000 color infrared aerial photos. Using GIS, polygons were placed into 4 upland categories, 6 wetland categories, 6 water regimes and a total wetland category. Total wetland, emergent wetland, and seasonally flooded water regime were all significant habitat components for crane nesting areas ($P < 0.01$). Forested uplands were significantly avoided as nesting habitat ($P < 0.01$). All differences in habitat selection were only significant within 200 m of the nest site. Beyond 200 m of the nest location, habitat selection was not documented because either a preference did not exist at this distance or it was not possible to detect habitat preferences on the larger scale. The authors advise exercising caution when determining habitat selection at a large scale. [Midcontinent Ecological Science Center, National Biological Service, 4512 McMurry Ave., Ft. Collins, CO 80525-3400, USA.]—Sherry Meyer.

ECOLOGY

(see 27, 28)

POPULATION DYNAMICS

(see also 1, 9, 12, 16, 17, 39, 41)

29. A re-evaluation of the numbers of migrant Semipalmated Sandpipers, *Calidris pusilla*, in the Bay of Fundy during fall migration. K. Mawhinney, P. W. Hicklin, and J. S. Boates.

1993. Can. Field-Nat. 107:19–23.—Fluorescent orange 1 m^2 quadrats of 0.5 cm plastic tubing were placed at roosting sites above the high tide line on Evangeline Beach, Kings County, Nova Scotia. Sandpipers were photographed as they stood in and around the quadrats. The slides were projected and the birds roosting within the quadrats were counted. The size of the roost was estimated from the photograph and the number of sandpipers was calculated by multiplying the number of birds/quadrat by the number of m^2 occupied by roosting birds. The results suggest that 1,122,000–2,200,000 Semipalmated Sandpipers roost on Evangeline Beach during the autumn migration. The new estimates are 37–67% higher than previous, less operational estimates and emphasize the importance of beaches at the head of the Bay of Fundy as stopover sites for migrating Semipalmated Sandpipers.—Edward H. Burtt, Jr.

30. Whooping Crane, *Grus Americana*, home range and breeding range expansion in Wood Buffalo National Park, 1970–1991. E. Kuyt. 1993. Can. Field-Nat. 107:1–13.—In 1970 15 pairs of Whooping Cranes bred in Wood Buffalo National Park along the Sass and Nyarling Rivers in southern Northwest Territories, Canada. Twenty-one years later in 1991 33 pairs bred in the park, the population having occupied the Klewi River basin and extended its range south into Alberta along the Little Buffalo River. Although aerial census techniques have improved since 1970 and the area covered has increased, the range occupied by the cranes remained about 400 km^2 for many years before increasing recently to 500 km^2. The small breeding range within the area censused suggests that the population growth is real and not a function of better techniques or the larger area covered. If the breeding habitat remains undisturbed and the population is able to commute to and overwinter successfully in Aransas National Wildlife Refuge, Texas, United States, the Whooping Crane population should continue to expand and will probably extend its range further south into northeastern Alberta.—Edward H. Burtt, Jr.

31. Evaluating causes of population changes in North American insectivorous songbirds. J. R. Sauer, G. W. Pendleton, and B. G. Peterjohn. 1996. Conserv. Biol. 10:465–478.—The North American Breeding Bird Survey is a major source of population data for North American species. There are complications to using BBS data for population analyses; a primary concern is that correlation studies based on BBS data cannot be used to define cause and effect relationships clearly. Major issues that should be accounted for when using BBS analyses include observer effects, data subsets, improved survey effort with time, weather, and confounding effects of multiple "independent" factors. The authors review a previously published paper that drew causative inferences to explain trends in population sizes of insectivorous migratory birds. A reanalysis of the previous publication included an alternative analysis method (route regression) and weightings to account for observer differences, survey efficiency and temporal biases. Results revealed migration status (as opposed to predation) as a major factor that was associated with population trends. The authors review the value and limits of observational data and conclude that it is critical to accommodate constraints of BBS through careful stratification. [National Biological Survey, Patuxent Environmental Science Center, Laurel, MD 20708, USA.]—Kristin E. Brugger.

32. Population trend estimates. L. Thomas and K. Martin. 1996. Conserv. Biol. 10:479–490.—A method validation was conducted to evaluate the relative results of 3 statistical approaches to analyzing Breeding Bird Survey (BBS) data. Trends for 115 species in British Columbia were estimated using U.S. National Biological Service route regression (NBSRR), Canadian Wildlife Service route regression (CWSRR) and nonparametric rank-trends analysis (NRTA). The number of species estimated as declining was similar among the methods. However, many differences were identified. The number of statistically significant declines differed (15, 9, 29, respectively). The CWSRR estimates returned values with greater absolute magnitude and fewer positive trends than NBSRR when each country's data selection criteria were followed. Results beg the questions (1) Which components of the methods have the largest effect on resulting estimates? and (2) Which method is the most accurate? Further evaluation is needed with simulated trend data before a recommendation can be made to conservationists who need such tools for management discussions. [Centre for Applied Conservation Biology, Univ. of British Columbia, Vancouver, BC V6T 1Z4, Canada.]—Kristin E. Brugger.

33. Long-distance breeding dispersal of Snowy Plovers in western North America. L. E. Stenzel, J. C. Warriner, J. S. Warriner, K. S. Wilson, F. C. Bidstrup, and G. W. Page. 1994. J. Anim. Ecol. 63:887–902.—Snowy Plovers (*Charadrius alexandrinus*) display a wide variety of dispersal behavior during the breeding season. During a six-year study at two coastal sites in California, 41% of females and 16% of males that regularly bred at the sites were absent either for part of one breeding season or between seasons. Some of these birds were found breeding at alternate sites from 50 km to 1140 km distant, mostly to the north. Some also went east (inland) and south. Alternate-site nesting was documented for 16 females and seven males. Snowy Plovers typically are monogamous for only one breeding cycle and the males brood the young (Warriner et al., Wilson Bull. 98:15–37, 1986), and therefore males have less opportunity than females to disperse to new breeding areas. Most observations of extra-site breeding were at wintering areas, and occurred when the resident plovers at the wintering area began breeding earlier than usual, or continued breeding later than usual. Only 39% of female and 49% of male Snowy Plovers leave their breeding areas to winter elsewhere (either north or south along the coast). Although breeding dispersal has been reported among many species, Stenzel et al.'s findings are significant because the dispersal occurs when resources are plentiful. They hypothesize that this behavior is useful during years when environmental conditions are sub-optimum.—Oliver Komar.

ZOOGEOGRAPHY AND DISTRIBUTION

(see 26)

EVOLUTION AND GENETICS

(see 20)

PHYSIOLOGY AND DEVELOPMENT

(see also 5, 36)

34. Basal metabolic rates of North Atlantic seabirds. D. M. Bryant and R. W. Furness. 1995. Ibis. 137:219–226.—This study measured basal metabolism of eleven species of seabirds and compared these measurements with the basal metabolic rates (BMRs) predicted by various allometric equations. These equations, taken from past studies, allowed for BMRs to be calculated from body mass. Non-breeding seabirds in full adult plumage were captured between March and August off the coast of Scotland; they represented a variety of body forms, feeding habits, plumage types, activity schedules, and body masses. As soon as possible after capture, the birds were fed and placed in a dark, carefully designed and monitored, metabolic chamber; the birds were in darkness to keep them in a 'resting' phase, thereby minimizing BMR elevation caused by movement. Twenty hours after feeding, when the birds were in a postabsorptive state, metabolic measurements were taken, after which the birds were released at sea. Many precautions were taken to ensure that the BMRs obtained would be as close as possible to the BMR each bird would have in its natural state. The 'resting' phase BMRs obtained from the measurements were higher than those predicted by the allometric equations, suggesting that direct measurements of seabirds must be done in order to accurately determine BMR. The only major conclusion to be drawn from the data was that North Atlantic seabirds have relatively high BMRs compared to the majority of birds. Further study in this area could lead to new allometric equations designed specifically for calculating the BMR of seabirds.—P. L. Clancy.

MORPHOLOGY AND ANATOMY

35. Structure and function of the nictitating membrane in the Rose Flamingo *Phoenicopterus ruber roseus*. [Struktur und Funktion der Nickhaut beim Rosaflamingo *Phoenicopterus ruber roseus*.] B. Daicker, R. Brückner, A. Heldstab, and O. Pagan. 1996. Ornithol. Beob. 93:59–68.—The nictitating membrane of the Rose Flamingo has a window in its center that is as transparent as the cornea. Because the refractory index of the membrane is the same as the cornea, it cannot serve to accommodate the eye for underwater vision. Its function appears to be to allow the bird to see better while feeding in muddy water while protecting the eye from foreign matter. [Universitäts-Augenlinik, Postfach, CH-4012 Basel, Switzerland.]—Robert C. Beason.

PLUMAGES AND MOLTS

36. Variation in the developmental timing of flight-feather growth in nestling birds. C. P. F. Redfern. 1994. Ibis 136:72–78.—Open nesters start primary-feather growth earlier in development and fledge at lower relative body weights than protected nesters which start primary-feather growth later in development and fledge at body-weights closer to adult values. Although the article required careful reading, this research supports the view that earlier development of flight is an adaptive strategy for species whose open nests are relatively accessible to predators. However, the variation in fledging weights of open nesters weakens the conclusion. Redfern suggests that open-nesting altricial birds begin growing flight feathers as soon as possible, but this process is influenced by the metabolic capacity of the nestling and the time required to complete growth of the flight feathers. These findings support the advantage of protected nesting sites for small altricial species.—Carrie Lippert.

PARASITES AND DISEASES

37. Threats to public health from gulls (*Laridae*). J. J. Hatch. 1996. Int. J. Environ. Health Research 6:5–16.—Many gull species are highly gregarious while feeding and nesting and are closely associated with humans. Many have experienced recent population increases, often the result of anthropocentric factors such as increased food supply associated with fishing boats and garbage dumps, and currently pose increased threats to public health. Expanding gull populations also may interfere with agriculture and aquaculture, cause problems at airports, and threaten other wildlife species. The greatest threat to public health seems to be through contamination of water supplies and recreational waters. For example, increased coliform counts in reservoirs have been associated with gulls. The risk may be high if large numbers of gulls feed at contaminated sites such as sewage outfalls and then visit reservoirs. In addition, gulls may infect livestock by contaminating pastures, and increased risks are experienced by visitors to gull colonies. For example Herring Gulls (*Larus argentatus*) have been implicated in the transmission of *Salmonella* to cattle, and several cases of suspected human viral infection have been linked to visits to marine bird colonies. Possible arbovirus transfer to humans, however, is not considered a public health problem. Existing evidence suggests that gulls act as dispersal agents for pathogens such as *Salmonella* rather than being primary sources, and may carry infective stages of some enteric protozoa such as *Giardia*. This review includes nearly 70 references and should be of interest to anyone who routinely works in gull colonies or is interested in avian-related public health problems [Dept. of Biology, Univ. of Massachusetts, Boston, MA 02125, USA.]—William E. Davis, Jr.

WILDLIFE MANAGEMENT AND ENVIRONMENTAL QUALITY

(see also 16, 27, 30, 37)

38. Aversive conditioning to reduce raven predation on California Least Tern eggs. M. L. Avery, M. A. Pavelka, D. L. Bergman, D. G. Decker, C. E. Knittle, and G. M. Linz. 1995. Colon. Waterbirds 18:131–138.—Common Raven (*Corvus corax*) predation on eggs of the endangered California Least Tern (*Sterna antillarum browni*) at colonies at the U.S. Marine Corps Base at Camp Pendleton, California, has been a problem and ravens were poisoned and shot from 1988–1991 as part of a predator control program. In 1991 the authors initiated experiments to determine the efficacy of alternative, nonlethal aversive conditioning to con-

trol predation using *Coternix* quail eggs injected with methiocarb, a cholinesterase-inhibiting substance which causes temporary illness when ingested. Ravens were banded and marked with numbered patagial tags. Treated eggs placed near raven nests were removed during the first four days after placement but rarely thereafter suggesting that ravens learned to avoid treated eggs. However, experiments involving a simulated tern colony suggested that learned aversion was site related, so that treated eggs must be placed at tern colonies to achieve the desired effect, preferably 2–3 weeks before Least Terns nest. In 1992 treated eggs were placed at the periphery of three Least Tern colonies prior to and during tern nesting and although territorial ravens were present, no predation on tern eggs occurred, and no ravens were shot. Furthermore territorial ravens, apparently aversive-conditioned, kept untrained ravens out of the area, thus affording added protection for the tern colony. This study should be of interest to anyone concerned with avian conservation or methods of predator control. [U.S. Dept. of Agriculture, Denver Wildlife Research Center, Florida Field Station, 2820 E. University Ave., Gainesville, FL 32641, USA.]—William E. Davis, Jr.

39. Ecological risk assessment of pesticides for terrestrial vertebrates: evaluation and application of the U.S. Environmental Protection Agency's quotient model. H. M. Tiebout and K. E. Brugger. 1995. Conserv. Biol. 9:1605–1618.—The USEPA employs a mathematical model to estimate ecological risks attributed to pesticide exposure as a way of understanding how such compounds might behave in the environment. For terrestrial vertebrates (primarily birds and mammals) a dietary risk factor is calculated by dividing exposure by toxicity. The risk factor may be linked to population mortality via probit analysis and is used to identify compounds that could present adverse impacts to the environment. New guidelines were introduced in 1992 for interpreting the risk factor, resulting in more rigorous decision-making criteria (e.g., dropping allowable avian mortality associated with a single application from 49.9% to 8.8%). The model requires 1 implicit and at least 11 explicit assumptions to be met. Realistic deviations in 3 assumptions were modeled, revealing a 6-fold increase in predicted impacts and pinpointing certain categories of birds as being at greater potential risk: small-bodied insectivorous passerines and endangered species. The new model was applied to a hypothetical scenario of an insectivorous passerine, Black-whiskered Vireo (*Vireo altiloquus barbatulus*), exposed to mosquito control insecticides. The model predicted a possible 42% population impact. There is a need for biologists to work with ecotoxicologists and regulatory scientists to improve risk estimates and biological bases for regulations. [Dept. of Biology, West Chester Univ., West Chester, PA 19383, USA.]—Kristin E. Brugger.

40. Bird interactions with utility structures: collision and electrocution, causes and mitigating measures. K. Bevanger. 1994. Ibis 136:412–425.—The author presents data on collision and electrocution of birds at power line structures. In a survey conducted by the author, 75% of Norwegian power companies said that birds have caused breaks in their power supply. However, 64% of the companies said that they have not made the necessary technical improvements in their districts to help end this problem. The author recognizes four causes of collisions: biological, topographical, meteorological, and technical. Numerous factors such as poor eyesight, flight behavior, location of lines, wing loading, wind conditions, and line configuration contribute to collisions. The question of what these companies can do to solve this problem is a tough one, as many different things have been tried including enlargement of structures, better lighting, and scaring methods. In some collisions, the bird may come in contact with the conductors located on the tops of utility structures, resulting in electrocution. Even the smallest bird can affect the efficiency of lines and have severe economic impacts on the surrounding area. Electrocution is not simply an economic problem, as several species of threatened birds, including the California Condor (*Gymnogyps californicus*), Imperial Eagle (*Aquila heliaca*), and Whooping Crane (*Grus americana*) are victims of these often fatal collision/electrocutions. The author concludes that as countries develop, more power lines will be built. To help offset this growth, power companies must make an effort to switch to bird friendly structures and avoid areas where birds are put at risk.—A. Chad Fahey.

41. The conservation of critically endangered flightless birds in New Zealand. M. N. Clout and J. L. Craig. 1995. Ibis 137:Supplement 1:181–190.—The flightless Kakapo (*Strigops habroptilus*) and Takahe (*Porphyrio mantelli*) both of New Zealand, were thought to be ex-

tinct. Now that living populations have been found efforts are being made to protect them from extinction. Discovering what factors threaten individual species is important in order to learn how all species can be protected. Programs to conserve the Kakapo include supplemental feeding and moving populations to predator free islands. The great efforts taken to prevent the extinction have so far resulted in a known population of 47 birds. Although this is an improvement, the majority of the birds are aging males. The efforts to preserve the Takahe include brood manipulation and artificial rearing as well as introduction to new islands. Current estimates place the population at about 230. A problem common to the study of all species is finding the birds in order to count them. Even if the populations are slowly rising the old age and the small number of breeders will make it difficult to reestablish unassisted populations of these species. Brood manipulation to increase the number of chicks reared in the wild would increase the populations and allow hope for natural breeding in the future. Protecting the birds against predators in their native habitat could also increase the population.—Elana M. Kopel.

MISCELLANEOUS

42. On the frequency and seasonality of roadkills of the Long-eared Owl (*Asio otus*) and the Tawny Owl (*Strix aluco*). [Zur Häufigkeit und Phanologie des Strassentodes von Waldohreule (*Asio otus*) und Waldkauz (*Strix aluco*).] U. Straka. 1995. Egretta 38:130–132 (in German).—Road-killed Long-eared and Tawny owls were recorded from sections totalling 11.7 km of the highway along the Danube near Vienna, Austria, between 1991 and 1994. Three Long-eared Owls were found between March and May; 3 Tawny Owls were found in March and April and 4 from September through November. Although the sample is small, the phenology is similar to that of road-killed Barred Owls (*Strix varia*) found in Mississippi (J. A. Jackson, unpublished data). [Institut für Zoologie, Universität für Bodenkultur, Gregor-Mendel-Strasse 33, A-1180, Vienna, Austria.]—Jerome A. Jackson.