RECENT LITERATURE

Edited by Edward H. Burtt, Jr.

MIGRATION, ORIENTATION, AND HOMING

1. Skylight polarization patterns at dusk influence migratory orientation in birds. K. P. Able. 1982. Nature 299:550–551.—While we now know that passerine migrants can rely on a number of environmental stimuli to guide their nocturnal movements, that the discovery of possible orientation cues used by migrants is not yet exhausted is suggested by this paper. Caged White-throated Sparrows (*Zonotrichia albicollis*) were presented linearly polarized light which differed in direction, thereby predictably changing the sparrows' orientation at dusk. The results suggest that skylight polarization at the time of sunset is an important directional cue for nocturnal migrants. It also raises a number of interesting questions regarding the relative importance of skylight polarization as an orientation cue relative to other directional sources, e.g. the setting sun itself and the earth's magnetic field, particularly in conditions where the birds would be exposed to more natural skylight polarization patterns than those used in this study.—Verner P. Bingman.

2. Effects of weather conditions on the intensity of diurnal migration, flight height and directional scatter in the Swiss lowlands. [Die Wetterabhängigkeit von Zugintensität, Zughöhe und Richtungsstreuung bei tagziehenden Vögeln im Schweizerischen Mittelland.] G. Hilgerloh. 1981. Ornithol. Beob. 78:245–263. (German: English Summary.)—The paper discusses 6 years of radar observations on diurnal autumn migration relative to migration intensity, height, and direction. The heaviest migration occurred in high pressure zones with tailwinds or weak headwinds. The height of migration is strongly influenced by wind direction: migration is higher with following winds. There was no discernable leading-line influence of the Alps.—Robert C. Beason.

POPULATION DYNAMICS

(see also 9, 25)

3. The changing status of the Kittiwake *Rissa tridactyla* in the British Isles, 1969–1979. J. C. Coulson. 1983. Bird Study 30:9–16.—Annual increases in the Kittiwake population of 3–4% from 1900 to 1969 and of 2% from 1969 to 1979 are discussed. An increase in colony size at one site, Bempton-Flamborough Cliffs, was responsible for much of the growth during the last decade. Concomitantly, decreases in population size occurred in southwest and northwest England, Wales, southwest Scotland, and south Ireland. Most of this decrease occurred during the years 1973–1975. Food shortages near colony sites, not toxic chemicals, are suggested to be the primary contributing factors. However, similar changes in other fish-eating seabird populations have not been reported in Britain.—Stephen R. Patton.

NESTING AND REPRODUCTION

(see also 13, 14, 15, 16, 24, 32, 33, 56)

4. Studies on breeding biology of 10 species of passerine birds in alpine meadow. X. A. Zhang. 1982. Acta Zool. Sin. 28:190–199. (Chinese: English summary.)—The breeding biology of 10 passerine species (*Eremophila alpestris, Alauda gulgula, Motacilla citreola, Pseudopodeces humilis, Prunella rubeculoides, Phoenicurus ochruros, Passer montanus, Montifringilla taczanowskii, M. ruficollis,* and *Acanthis flavirostris*) was studied during April–August, 1976–1980 at the Alpine Meadow Ecosystem Site at Feng Xia Kou, Hai Bei, in Qinghai Province. The breeding season of these species was characteristically short and 2 species, *M. citreola* and *A. flavirostris,* were observed to complete breeding activities within 2 months. Three species (*P. humilis, M. taczanowskii,* and *M. ruficollis*) nested in rodent burrows, 4 (*E. alpestris, A. gulgula, M. citreola,* and *P. rubeculoides*) nested on the ground, 2 (*P. ochruros* and *P. montanus*) nested in rock crevices or in the cavities of walls, and one species (*A. flavirostris*) nested in the branches of shrubs.

The major findings of this study are summarized below. However, I would suggest caution in using the data presented since the author has apparently pooled all available data to estimate the various parameters of the breeding season. *E. alpestris* and *A. gulgula,* 2 ground-nesting species, were observed to have the highest density of breeding individuals (2.403 and 1.892/ha respectively). These 2 species were further distinguished by the fact that 30 and 20% (respectively) of the breeding females attempted second clutches. In contrast to species with other nesting habits, the burrow-nesting species had the largest clutch size (4.5–5.90), the highest hatching success (96.1–96.9%), the highest number of young hatched per nest (4.12–4.78), the highest number of young fledged per nest (3.43–3.67), the highest juvenile weight index (fledgling weight/mean adult weight; 0.9555–1.064), and the longest nestling period (15–25 days). Ground-nesting species were noteworthy in exhibiting the highest fledging success (85.1–95%). The dominance of *E. alpestris* and *A. gulgula* in this habitat is attributed to their high fledging success and the production of a second clutch. There was little year-to-year variation in the clutch size of *E. alpestris* and *A. gulgula,* but there appeared to be a gradual increase in clutch size in both species as the breeding season progressed. Comparable data were not presented for the other 8 species. There was no correlation between hatchling weight and fledgling weight, but there was a significant correlation between the ratio of hatchling weight/fledgling weight, and fledging success. The author suggested that growth rate studies are needed to clarify the significance of this finding. Predation is considered to be the main source of mortality in eggs and nestlings, although this was only documented for 5 out of the 10 species.—Marina Wong.

5. Observations on the harrier hawk *Polyboroides typus* in Nigeria, with comparative notes on the neotropical crane hawk *Geranospiza caerulescens.* C. Smeenk and N. Smeenk-Enserink. 1983. Ardea 71:133–143.—The breeding season coincided with the end of the dry season while in moister parts of Africa the breeding was generally earlier, but also correlated with rainfall. The authors found that "blushing" of yellow facial skin to a red or pink usually was connected with reproductive activities such as copulation and prey exchange. The breeding events are chronicled relative to the onset of nest building. Incubation lasted 37–38 days and when chicks were lost replacement clutches were laid. Young remained with parents about 7 months post-fledging. Hunting is described and the authors conclude that, although *Geranospiza* shares several peculiar anatomical traits with *Polyboroides* (e.g., a peculiar intertarsal joint), they differ in hunting modes, covering of the soft parts, downy and juvenal plumages, voice, and egg-shell pattern. They suggest the similarities are a result of convergence and that *Polyboroides* is related to *Melierax* while *Geranospiza* is likely a buteonine.—Clayton M. White.

6. Multi-brooding and mate infidelity in the Sand Martin. E. Cowley. 1983. Bird Study 30:1–7.—Studies of *Riparia riparia* at a colony in Nottinghamshire provided data on sex ratios of adults (51% females, 49% males, n = 357) and demonstrated the occurrence of a seasonal turnover of colony members. Roughly half (41.8%) of the 419 trapped birds were not handled again after they fledged a brood in June; 15% were first trapped after mid-July, concomitant with an increase in new nesting activity. Some of these latter birds (9 of 61) were known to have bred elsewhere earlier that season. In 1981, 8 of 9 individually marked females started prospecting for new nest holes while their mates continued to feed young. Three of these females were escorted to these holes by new mates at this time. These females re-paired and fledged young from their second broods earlier than second broods of their original mates.—Stephen R. Patton.

7. Biology of the Yellow-shouldered Blackbird-*Agelaius* on a tropical island. W. Post. 1981. Bull. Fla. State Mus. Biol. Sci. 26:125–202.—The comparative approach to social behavior has proven to be quite powerful. For example, theories relating the social systems of animals to ecological factors have been satisfactorily tested by comparing the behavior of the same or related species in different habitats. The blackbird genus *Agelaius,* with 9 species in different tropical and temperate habitats, is ideally suited for such an approach. Seven of the 9 *Agelaius* are marsh nesters while the Yellow-shouldered (*A. xanthomus*) and Tawny-shouldered (*A. humeralis*) blackbirds, both of the Greater Antilles, are inhabitants of savannahs and mangrove habitats.

Post studied the biology of the Yellow-shouldered Blackbird on Puerto Rico to examine the hypothesis that the blackbird social system is a product of two factors: (1) the type and distribution of food and (2) the pattern and intensity of predation. This work was conducted over a 4-year period during both the breeding and nonbreeding seasons with 500 color-banded birds.

Yellow-shouldered Blackbirds nest in aggregations in mangroves (both isolated cays and isolated trees on salt flats), scattered trees in pastures, and in suburbs. The average distance between nests in colonies was 16 m and Post found that the colonies result from active attraction by colony members rather than a limited distribution of nest sites. Colony sites are isolated from feeding grounds (most food brought to nestlings is gathered up to 2 km from nests) where food (mostly arthropods) is scattered in large patches. Post argues that nest aggregation is a result of predation pressure rather than the dispersion of food supply. His conclusion is based upon the frequency of communal mobbing by colony members, the large number of displays used in the presence of predators, inaccessible nest sites, and high nest predation rates.

All breeding birds were monogamous; there was no evidence for polygyny. Parental duties of the male preclude the possibility of male emancipation. A long period of pair affiliation was found prior to breeding which might be advantageous by allowing the pair to respond to unpredictable rainfall and assures mate fidelity.

This thorough study also includes data on the timing of breeding, age of first breeding, time budgets of both males and females at the nest, nestling growth rates, nestling and adult diets, reproductive success, levels of cowbird parasitism, sex ratios, survivorship, home ranges, foraging behavior, vocalizations, and visual displays. These findings are discussed in relation to comparable data from other *Agelaius* studies in addition to more general studies of tropical species. This is one of the most complete studies of the biology of a Caribbean passerine.—J. M. Wunderle, Jr.

8. Breeding ecology of the Rockhopper Penguin (*Eudyptes crestatus*) in the Falkland Islands. I. J. Strange. 1982. Gerfaut 72:137–188.—This exhaustive monograph concerns the natural history of Rockhopper Penguins that populate the Falkland Islands each year between October and April. I. J. Strange brings together an immense wealth of information from field work throughout the islands since the early 1960's, but deals mostly with the Settlement Rookery on New Island, which he studied intensively between 1977 and 1981. He describes the physical characteristics of the rookeries and virtually all of the birds' activities therein. The text is more than amply illustrated with photographs of rookeries and penguins, maps, line drawings of the birds' external anatomy, and a very useful figure with a chronology of the activities of breeding and nonbreeding penguins.

The rookeries of Rockhopper Penguins are situated near places where the Falkland Current creates upwellings in coastal waters, are usually on highly elevated parts of the coastline, and invariably include deep water approaches. Each has separate landing/exiting zones, preening and drying areas, and breeding grounds. The landing/exiting areas are typically inclined shelves or slabs of rock that drop off abruptly into the sea. The neighboring preening and drying zones may be on steep cliff faces or flat boulder-strewn ground. Breeding areas are exposed and either at high elevations overlooking the sea or 50–100 m inland. Breeding areas always have a source of fresh water from which the birds drink, particularly during egg-laying and incubation periods. To reach these breeding areas, penguins use well-defined, apparently traditional trails. Rockhopper Penguins commonly breed in company with small numbers of Black-browed Albatrosses (*Diomedea melanophris*) or Macaroni Penguins (*E. chrysolophus*).

Small groups of male penguins arrive at the Falkland Islands in October. Not only do males return to the same nest site used in the previous breeding season, but they also return in the company of previous neighbors (perhaps birds from a particular neighborhood remain together at sea). Males occupy breeding sites and build a nest. When the females return, pair bonds are established and copulation follows directly. The first egg is laid 11 days after copulation and a second, larger one 5 days later. Both parents share incubation duties initially, but males soon leave the colony en masse to forage at sea for 7–10 days. When they return and relieve the females, the latter do the same. Females do not return to the rookery until the eggs are hatching or immediately thereafter. Unlike

Rockhopper Penguins elsewhere, pairs on the Falkland Islands commonly incubate *both* eggs to hatching and then rear *both* chicks successfully.

Chicks are in the nest for 20 days, protected and fed by both parents. They then assemble into crèches (guarded by adults that have not bred successfully) which persist until they are 40–45 days old. They then molt (requires 16–18 days) and abandon the rookery. Adults lead them to the landing/exiting zones and apparently entice them into the surf; adults leave the rookery themselves at this time (for 20–25 days) to feed at sea in preparation for the molt. Feather replacement occurs when the adults return to the rookery and requires 10–15 days, females beginning earlier than males. Penguins lose a staggering 40–47% of their body mass while replacing the plumage. They then disappear from the rookeries for another year. With few exceptions the birds are gone by mid-April.

Little is known about their activities after they leave the islands, but pelagic birds from the Falkland populations have been reported as far north as 35°S latitude. Breeding individuals are at sea for 6 months, whereas nonbreeders remain there for 9 or more months depending on their ages.

Predators of eggs and chicks include Skuas (*Catharacta skua antarcticus*), Dolphin Gulls (*Larus scoresbii*), and the Striated Caracara (*Phalcoboenus australis*). Chick mortality is highest immediately after hatching, but even young that have left the nest frequently succumb, particularly when exposed to cold, wet weather. Chick survival during 1977–1979 was 39–42%. In contrast, adult penguins are relatively safe on land, unless they are injured or stunned (e.g., while landing during storms), in which case they may become a meal for Giant Petrels (*Macronectes giganteus*). At sea, they are subject to predation by Southern sea lions (*Otaria byronia*).

Strange also describes the plumage, mass, and measurements of each age class of penguins. Differences in the color of the skin edging the bill and in the form of the occipital crest and superciliary plumes make populations from the Falkland Islands, Staten Island, and the Magellanic areas subspecifically distinct from Rockhopper Penguins found elsewhere. Growth lines in the skin at the base of the bill may be useful for aging penguins because such lines are absent in 1- and 2-year-old birds, but numerous in old ones. The pigmentation on the leading edge of the flippers also exhibits age-related differences. The sexes can usually be distinguished in the field on the basis of bill size (deeper in males) and aggressive behavior (more pronounced in males).

Some of the more important behavioral patterns of Rockhopper Penguins are also described in this paper, e.g., the stooping walk attitude, slapping, threat, allopreening, guarding, mutual trumpeting, and alarm postures. Add to these descriptions of prehatching, copulatory, and drinking behavior.

This is a thorough description of what happens to Rockhopper Penguins during their stay at the Falkland Islands based on an impressively large set of data.—Michael D. Kern.

9. Nesting ecology of *Anser canagicus* in northern Chukot Peninsula (Ekologiia gnezdovaniia gusia-belosheia (*Philacte canadica* [sic]) na severe Chukotskogo poluostrova). A. V. Krechmar and A. Yu. Kondrative. 1982. Zool. Zh. 51:254–264. (Russian: English summary.)—This rare subarctic species returns to nesting grounds in the Chuktosk Peninsula, USSR, at the end of May, and lays eggs after 10–15 days, during which mated pairs build or renovate nests. Nests are almost always very close to water (0.5–1.5 m), sometimes on islets. A full clutch averages 4.17 ± 1.02 eggs; occasionally one goose will deposit her eggs in another's nest. Until the clutch is complete the goose is only sporadically on the nest and the earlier eggs are thus not warm enough to develop much faster than their later siblings. When the clutch is finished, the mother bird spends 95–98% of her time on the nest, and the clutch's temperature remains fairly stable even during her absences. The absolute temperature varies from nest to nest and affects the duration of incubation.

The Emperor Goose's fertility is high and embryonic mortality low. Almost as soon as the last gosling has dried, the goose leads her brood to water and urges them to swim; the family will return to the nest for a night or two but then spend the rest of the goslings' growing period in the grasses along the shore. In contrast to the Wrangel Island population of Snow Geese, which has suffered from unfavorable weather during recent breeding seasons, the Emperors, nesting a month later on the mainland, are less affected by weather and the decline in their population is attributable more to hunting, feral dogs, and disturbance.—Elizabeth C. Anderson.

BEHAVIOR

(see also 5, 6, 7, 8, 48, 55, 56)

10. On the prehatching interactions in domestic chickens. R. Tuculescu and J. Griswold. 1983. Anim. Behav. 31:1–10.—Tuculescu and Griswold examined the relationship of 7 embryonic vocalization patterns of the White Leghorn and 9 behavior patterns of maternal Minorca Rose Comb Bantam hens. They took incubated eggs of 15–18 days and replaced the hen's own eggs, placing 6 under each. A camera and recorder were set up to observe and record any movements or sounds. The 7 embryonic vocalizations were grouped into "distress" and "pleasure" calls (based on Guyomarc'h, Z. Tierpsychol. 23:141–160, 1966). The distress calls were indicated by a spectrum drop in frequency and the pleasure calls were indicated by an increase in frequency. Tuculescu and Griswold observed the first calls from the embryonic chicks on the 19th day of incubation, with an increase in calls as hatching approached. Pleasure calls from the embryonic chicks were found to significantly follow "clucks" from the maternal hen. The 9 maternal behavior patterns were broken into 3 categories: vocalizations, body movement, and head movement. Egg turning by the hen elicited the most dramatic effect: complete embryonic silence. From their observations, Tuculescu and Griswold concluded that embryonic chicks responded to maternal behavior and that synchrony of maternal behavior and embryonic vocalization occurred as hatching approached. Although the studies that were performed used small numbers of chicks and hens, we can only wonder at the effects upon artificially incubated chicks and the possible species-specific relationships in other avian species.—James W. Shellard.

11. Social behavior of Black Grouse—an observational and experimental field study. G. J. DeVos. 1983. Ardea 71:1–103.—This is a rather long, complex, and detailed study that deals with such topics as habitat and individual home ranges, flocking behavior (such as gregariousness and arena flocking), territoriality, and life history of males (longevity, mortality, copulation success), etc. Most attention was paid to the males and the behavior of Black Grouse is compared to other arena species. Individual spacing pattern was important. Most males restricted their activities to particular areas and thus showed strong site attachment. The home range of these males was of course smaller than that of other individuals. Males with display sites close to one another also tended to have overlapping home ranges.

Males with central territories on the same arena were very gregarious and associated with males from adjacent territories in the same arena. Site attachment of these males did not interfere with gregariousness. In contrast, site attachment of solitary or marginal arena males tended to interfere with their gregariousness.

Display site attachment and territory defense appeared to be closely linked. The tendency to be aggressive to conspecifics was site dependent and highest in the neighborhood of display sites. This defensiveness tended to lead to the establishment of a territory in that locality.

Life span was maximally about 8 years but on average was 4 years for males. Some males were able to establish a territory when 1 year old but most did not until 2 years old. The central males tended to be older because territories were usually established for the first time on the margin of the arena. The author concludes that although some interspecific differences exist (such as size of arena, number of males, or success of juvenile males) among arena grouse, the social organization is essentially the same for all species.—Clayton M. White.

12. The post-roost gatherings of wintering Barnacle Geese: information centers? R. C. Ydenberg, H. H. Th. Prins, and J. van Dijk. 1983. Ardea 71:125–131.—The authors noted that Barnacle Geese (*Branta leucopsis*) leaving the overnight roost made a prolonged stop-over at a site enroute to the foraging grounds. The duration of the stop-over was determined by low temperature and, presumably, low food availability. They conclude that the increase in the duration of the post-roost gathering following long days of foraging is due to increased consideration that more geese must give to seeking other foraging sites.—Clayton M. White.

13. Aggression in female Red-winged Blackbirds: a strategy to ensure male parental investment. K. Yasukawa and W. A. Searcy. 1982. Behav. Ecol. Sociobiol. 11:13–17.—Ever since David Lack's classic experiments on aggression in Robins, ornithologists have known a simple and highly effective experimental manipulation for eliciting aggression in birds. Yasukawa and Searcy have used the technique—presentation of a model conspecific—to examine the evolutionary origins of female-female aggression in Red-winged Blackbirds (*Agelaius phoeniceus*). Very few studies have described female-female aggression or examined the evolutionary origins of such aggression, so this is a timely addition to the literature on the sociobiology of females. The study differentiates among 3 hypotheses for female-female aggression: (1) attacks are an anti-predator strategy; (2) attacks are a territorial defense of food resources around the nest and the nest site itself; (3) attacks are a form of investment guarding.

The experimental results support the interpretation that female-female aggression may guard the male's parental investment. These findings are that resident females are more likely to attack mounts in soliciting postures rather than perched postures and that primary females—those more likely to benefit from male parental care—were more likely to attack mounts than secondary females. Would Yasukawa and Searcy modify their conclusions if they considered their results in light of another hypothesis—that female-female aggression is a form of protection of maternity certainty?—Patricia Adair Gowaty.

14. Two hens, but a single nest: an unusual case of polygyny by Hen Harriers in Orkney. N. Picozzi. Br. Birds 76:123–128.—This well-documented anecdotal report of communal nesting by Hen Harriers (*Circus cyaneus*) is accompanied by extraordinary photographs of the 2 females simultaneously incubating and feeding nestlings. Two females nested with one male; an initial 12-egg clutch was laid in 24 days. Only 4 of the eggs hatched and these nestlings died. The author fostered 2 chicks at the nest in an effort to further document the cooperative behavior of the females. Both of the fostered chicks fledged. The report engages in no speculation on the evolutionary origins of cooperative polygyny; nevertheless, it should be of interest to students of mating systems and those interested in variability of breeding behavior.—Patricia Adair Gowaty.

15. Female sociality in the Common Eider Duck during brood rearing. J. K. Schmutz, R. J. Robertson, and F. Cooke. 1982. Can. J. Zool. 60:3326–3331.—This study of a non-migratory race of Common Eider Ducks (*Somateria mollissima sedentaria*) in Hudson Bay raises some interesting questions although it provides no clear answers. The basic question is why do "aunts," i.e., females that have either lost their own clutch or never laid one in the first place, accompany other females and their young? The proximate cause of high prolactin levels in "aunts" leading to their exhibiting brooding behavior is considered and rejected as "aunts" had prolactin levels equal to those of males and significantly below those of incubating females. The ultimate causes of enhancing survival of ducklings—either an inclusive fitness or group selection type argument depending on the "aunts'" relationships—or of enhancing the "aunts'" own survival were also considered although without gathering original data. Rather they cite Campbell (Ornis Scand. 6:27–32, 1975) who reported that there was no difference in predation rate on broods accompanied by "aunts" and broods not so accompanied. This leaves the possibility that "aunts" accompany other females and their broods just as a form of flocking behavior that enhances the "aunts'" survival by lessening their chances of falling victim to predation. Data on this possibility are yet to be gathered by anyone.—A. John Gatz, Jr.

16. Parental behavior in Lapwings (Charadriidae) and its relationships with clutch sizes and mating systems. J. R. Walters. 1982. Evolution 36:1030–1040.—The assumption that parental behavior is not demanding in precocial birds and that polygamy is favored in such situations was evaluated. Four species of lapwings were studied at 2 sites; Long-toed Lapwings (*Vanellus crassirostris*), Blacksmith Plovers (*V. armatus*), and Crowned

Lapwings (*V. coronatus*) in Amboseli National Park, Kenya, and Southern Lapwings (*V. chilensis*) near Mantecal, Venezuela. Based on 7 types of parental behavior, Southern and Crowned lapwings were labeled as active tenders of the young, while Blacksmith Plovers and Long-toed Lapwings were labeled inactive tenders. Active tenders showed increased time for parental behavior with increased brood size, whereas the time cost for inactive tenders was less sensitive to brood size. The authors also observed that clutch sizes were generally smaller for active tenders than inactive tenders. However, in both cases, parenting time was considerable. With regard to mating systems, polygamy may occur in inactive tenders due to a decrease in parental time care. However, the 4 species practiced 2-parent care, with 3 birds sometimes tending one brood in one of the actively tending species. While the author's data seemed thorough, additional data with larger sample sizes would strengthen his main points.—Fred Roberts.

17. Space use, territoriality and breeding season of the Mediterranean warblers (*Sylvia melanocephala, S. undata, S. cantillans* and *S. hortensis*) in southern France. [Zu Raumnutzung, Territorialität and Legebeginn mediterraner Grasmücken (*Sylvia melanocephala, S. undata, S. cantillans, S. hortensis*) in Südfrankreich]. N. Zbinden and J. Blondel. 1981. Ornithol. Beob. 78:217–231. (German: English summary.)—The amount of habitat overlap among the species under study depended largely upon the size of the habitat patches. If patch sizes were small, there was much overlap in habitat use. Large patch sizes allowed the species to segregate according to habitat preferences. Migratory species show more intense territorial behavior in spring than resident species, suggesting that territories may be established in the autumn for the latter species. Interspecific territoriality was not observed.—Robert C. Beason.

18. Taste-aversion conditioning of crows to control predation on eggs. L. K. Nicolaus, J. F. Cassel, R. B. Carlson, and C. R. Gustavson. 1983. Science 220:212–214.—Presumably, Batesian mimics are maintained through the predator's avoidance of animals with color patterns that resemble noxious prey. The majority of mimics are avoided only when predators have consumed noxious models that produce illness. This report examines illness-induced aversions among Crows (*Corvus brachyrhynchos*) and suggests that such a conditioning process may be a powerful factor in the evolution of Batesian mimicry and a practical tool for wildlife biologists.

Two experiments were designed to evaluate the usefulness of a taste-aversion agent in producing a visual avoidance to green-colored eggs by wild crows and to determine the degree to which crows might generalize their conditioning from the noxious baits. In the first experiment, 5 treatment and 5 control sites each contained a line of 20 straw nests at 15 m intervals on the ground. Half the nests at each site contained one chicken egg painted green; the others had one white, unpainted chicken egg. The egg sequence was randomized and only green eggs in the treatment sites were injected with a noxious agent. The results demonstrate that crows at the treatment site ate fewer green eggs (=noxious agent) than white eggs and fewer green eggs (=tasty eggs) than did crows at the control site. Avoidance of green eggs (with noxious agent) at treatment sites indicates successful taste-aversion conditioning, while white eggs were still removed by crows.

In the second experiment, the strength of the taste aversion already established among crows at the treatment site (in experiment 1) was tested by depriving the crows of "safe" white eggs at their earlier feeding sites. The results of this experiment show that crows avoided nontoxic green eggs as well as toxic ones, but continued to eat white eggs. These well-designed experiments add to our knowledge of conditioning in wild populations.—J. M. Wunderle, Jr.

ECOLOGY

(see also 4, 17, 28, 29, 51)

19. The trophic structure of sympatric assemblages of diurnal and nocturnal birds of prey. F. M. Jaksić. 1983. Am. Midl. Nat. 109:152–162.—Owls have often been considered nocturnal, ecological equivalents of diurnal hawks. Jaksić examines this hypothesis by comparing the food-niche breadths, food-niche overlaps, and mean prey weights of 5 assemblages of diurnal and nocturnal birds of prey. Data for his analysis were taken from previously published studies of raptors in Michigan, Wisconsin, Utah, Spain, and Chile. With only a few exceptions, no significant differences were found among sympatric assemblages of hawks and owls in the statistical distributions of raptor weights and the 3 trophic estimators mentioned above. Positive correlations were found between raptor weights and mean prey weight, but not between raptor weights and food-niche breadths within hawk and owl assemblages. Parallel geographic variation in hawk and owl assemblages was found in species richness (always higher for hawks), sizes, and trophic estimators. The author concludes that both diurnal and nocturnal raptors are opportunistic predators that vary their trophic relationships according to available food resources and hence sympatric assemblages of hawks and owls have very similar trophic structure which covaries geographically.

Left unanswered is the question of why hawks and owls have similar patterns of food-niche breadth, overlap, and mean prey size taken despite the findings that hawk species outnumbered owl species at all localities. The author suggests that either owl assemblages are relatively unsaturated with species or that some resources are less susceptible to partitioning by nocturnal raptors. This suggests that further investigations would be valuable.—J. M. Wunderle, Jr.

20. Ecological community theory and the coexistence of sparrows. H. R. Pulliam. 1983. Ecology 64:45–52.—Whether or not various ecological communities are structured by exploitation competition for food resources is a proposition not frequently tested in a quantitative manner. Here Pulliam compares the actual number of resident sparrow species present on each of 4 habitats with the numbers predicted by community theory and a random model. The accuracy of the community theory predictions was not very high (5 of 14, or 29%) and not significantly better than the expectations based on the random model. Ten of the 25 iterations of randomly generated communities showed accuracies of 29% or better, although the average accuracy was only 4 of 14. The predictions of both the community theory and the random model were improved by incorporating information on resource thresholds, specifically not predicting the presence of a given species if it was known that food production was below some minimum needed by the species. Still, the randomly generated community structures were at least as accurate if not more accurate than those predicted by exploitation competition about half of the time. Pulliam admits that there are enough problems with his methods of data collection that he would not advocate throwing out community theory just yet. On the other hand, various bits of information reported almost anecdotally support Pulliam's suggestion that for these sparrows it might be reasonable to attempt to devise a model either based on or at least incorporating interference competition. Rigorous testing of models as is done here is highly desirable work, and the results indicate the continued need for alternative theoretical models to those currently in use.—A. John Gatz, Jr.

21. Niche dynamics and organization of waterfowl guilds in variable environments. T. D. Nudds. 1983. Ecology 64:319–330.—Whether or not competition has a role in structuring communities is becoming increasingly tested, and Nudds' paper presents one such test. Nudds examined variation in annual densities for 35 yr of data for 8 species each of diving and dabbling ducks that breed in the prairie-pothole region of Canada. These data gave him measures of changes in species diversity (D_s) over time which he could then relate to indices of niche separation (F) that he obtained from discriminant function analysis of variation in breeding habitat use and of niche space (D_r) obtained directly as "the total number of potholes available." He compared his results to the following alternative theoretical predictions: (1) in a stable environment, D_s and F should be positively correlated whereas D_s and D_r should show no correlation if the communities are structured according to Pianka's niche overlap hypothesis; (2) in an unstable environment, competition should not cause any structuring so that D_s and F should have a negative correlation and D_s and D_r should have a positive correlation; and (3) in an environment of intermediate stability in which some competitive structuring exists, D_s and F should show no correlation whereas D_s and D_r would be positively correlated. Nudds' results for all 4 guilds studied—parkland divers, parkland dabblers, prairie divers, and prairie dabblers—indicated some role for competition in the structuring of all communities. Parkland divers bred in ponds with the least annual variation in numbers, and their patterns of variation in species diversity fit those expected for a stable environment (prediction 1 above). Parkland dabblers and prairie divers, breeding in habitats of lower stability, showed diversity patterns fitting prediction 3. The final guild, prairie dabblers, bred in the least stable environment and fit prediction 3 only partially. Prairie dabblers showed the expected lack of correlation between D_s and F, but had a negative rather than the expected positive correlation between D_s and D_r. Overall, Nudds quite reasonably interprets his results as indicating competition has been important over evolutionary time in all communities, and that its importance in ecological time varies directly with environmental stability.—A. John Gatz, Jr.

22. Habitat relationships of summer resident birds in slash pine flatwoods. A. S. Johnson and J. L. Landers. 1982. J. Wildl. Manage. 46:416–428.—This study examines breeding songbird abundance, species composition, and diversity with regard to forest regeneration method, stand age, and fire history in natural stands and plantations of slash pine (*Pinus elliottii*) in southeastern Georgia. Additional census data from mature mixed hardwood and pine-cypress (*Pinus-Taxodium*) stands are compared to those of pine stands, and relationships of bird community indices to habitat components are discussed. Bird community indices followed a successional trend from areas fallow for 1–2 yr following timber harvest, through young (to 10 yr) and old (to 28 yr) pine stands, to pine-cypress and mixed hardwood stands. Complexity of habitat components (herbaceous vegetation, low woody plants, residual hardwoods, and snags) in fallow areas made them attractive to birds. After pine stands reached mid-rotation age (16–28 yr), bird communities were not affected by the origin of stands (natural regeneration versus site preparation and planting), stand age, or years since burning. No strong correlations were found between bird community indices and variables for stand density, understory, and fruit availability. Wet hardwood sites were inhabited by 17 species that were absent or rare in pine stands (including Bachman's Warbler, *Vermivora bachmanii*!?). Mixed stands, especially mature hardwoods, are thus important for the maintenance of avifaunal diversity in these intensively managed pine forests. Conversion of southern hardwoods to pine plantations should be discouraged.—Richard A. Lent.

23. Feeding ecology of Middle-spotted and Great-spotted woodpeckers (*Picoides medius* and *P. major*) with notes on the distribution of the Middle-spotted Woodpecker. [Habitatnutzung, Nahrungserwerb und Nahrung von Mittel- und Buntspecht (*Dendrocopus medius* [sic] and *D. major* [sic]) sowie Bemerkungen zur Verbreitungsgeschichte des Mittelspechts.] L. Jenni. 1983. Ornithol. Beob. 80:29–57. (German: English and French summaries.)—The study compares *P. major* and *P. medius* habitat use, foraging techniques, and movement patterns. During the winter both species preferred oaks (*Quercus* spp.), with dead limbs selected 70% of the time. Differences in foraging behavior were greatest in winter: *P. major* hammered 90% of the time and *P. medius* probed 90% of its foraging time. Consequently *P. medius* moved quickly and spent less time at each site than *P. major*. *P. major* preferred the upper canopy and *P. medius* preferred the lower canopy and trunk. In spring *P. medius* used the upper canopy, while *P. major* used upper and lower canopy and trunks. Both species spent only 40% of their time on dead limbs, with *P. major* using all tree species while *P. medius* still used only oaks. After the leaves began sprouting, both species used gleaning as their primary foraging technique. The 2 species thus appear to reduce interspecific competition by differences in foraging techniques in winter and by differences in tree species in spring.—Robert C. Beason.

WILDLIFE MANAGEMENT AND ECONOMIC ORNITHOLOGY

(see also 22)

24. Nest box use by cavity-nesting birds. G. R. Willner, J. E. Gates, and W. J. Devlin. 1983. Am. Midl. Nat. 109:194–201.—The use of nest boxes by the Eastern Bluebird (*Sialia sialis*), House Wren (*Troglodytes aedon*), Tree Swallow (*Tachycineta bicolor*), House Sparrow (*Passer domesticus*), and Tufted Titmouse (*Parus bicolor*) was studied at 2

Maryland locations. Twenty-four box and habitat variables were measured at each location. A discriminant function analysis was used to segregate the boxes used by Bluebirds, Tree Swallows, and House Wrens. A discriminant function model developed in one locality was used to classify nest boxes at the other locality where 81% of the Eastern Bluebird boxes were classified correctly. The authors conclude by suggesting the obvious—"Use of nest boxes by the Eastern Bluebird can be enhanced by placing them in the correct habitat configuration."—J. M. Wunderle, Jr.

25. The effects of culling on the Abbeystead and Mallowdale gullery. S. Wanless and D. R. Langslow. 1983. Bird Study 30:17–23.—Prior to 4 annual culls initiated in 1978, the Abbeystead colony site supported 25,000 pairs of gulls: 90% *Larus fuscus* and 10% *L. argentatus.* The proportion of the breeding population culled each year ranged from 27% in 1979 to 47% in 1978. The number of birds breeding each year following a cull differed by as much as 100% from the number of birds expected from a survivorship rate of 0.935. The rate of recruitment to the colony also varied substantially each year (0–53%). Gulls occupied the same total area throughout the study, but nest density at the site decreased from 0.4 to 0.2 nests/100 m^2. Areas with low nest densities prior to the culls changed less than areas of high nest density.

The authors suggest that an annual cull of 30% of the breeding population is necessary if colony size is to be lowered. They do not address important questions regarding the effects of such a cull on gull populations at neighboring colony sites. The preliminary and extremely variable survival and recruitment rate data reported in this paper are intriguing and deserve further study.—Stephen R. Patton.

26. Seasonal, habitat, and sex-specific food habits of Red-winged Blackbirds: implications for agriculture. D. K. McNicol, R. J. Robertson, and P. J. Weatherhead. 1982. Can. J. Zool. 60:3282–3289.—The authors used crop and gizzard samples to study the seasonal shifts in diet of Red-winged Blackbirds (*Agelaius phoeniceus*) during the birds' entire period of residency in eastern Ontario. The underlying motivation was to obtain information useful to a cost/benefit analysis of the species relative to agriculture in an area where corn damage was extensive. Their results showed granivory on waste grain (grain spilled during harvest) and weed seeds during the prebreeding months, insectivory during the breeding season, and a return to granivory thereafter. Of the >70% of the diet that was insects from May–July, approximately 90% of the species were classified as harmful to man. The birds also ate tremendous quantities of weed seeds (up to 70% of the diet for females in October) and substantial quantities of waste grain from the ground thereby denying this resource to rodent pests. Based on previous work, McNicol et al. conclude that damage is done to standing corn only in August and early September. While no bottom line is presented, clearly there are enough potential benefits to the presence of blackbirds that no widespread "control" programs on the species should be attempted until results like these can be assimilated into an economic model.—A. John Gatz, Jr.

27. Avian use of vertical strata and plantings in farmstead shelterbelts. R. H. Yahner. 1982. J. Wildl. Manage. 46:50–60.—Farmstead shelterbelts in Minnesota supported 28 species of birds, most concentrating on use of the ground stratum. Birds preferred plantings of *Picea, Populus, Acer, Lonicera,* and *Ulmus*; inclusion of these genera in shelterbelts would benefit birds in agricultural regions. Ecological generalists appeared to be best suited for use of shelterbelts. Factor analysis broke the shelterbelt bird community into 6 groups based on relative use of vertical strata and plant genera. Seasonal use of vertical strata and plantings is also discussed. Table 2 has no title, making it hard to interpret.—Richard A. Lent.

28. Bird population patterns in forest edge and strip vegetation at Remington Farms, Maryland. K. A. Morgan and J. E. Gates. 1982. J. Wildl. Manage. 46:933–944.—Bird species richness (S), abundance (A), and diversity (H) were examined in 6 habitat configurations: forest edge, forest edge with multiflora rose (*Rosa multiflora*) hedgerow, tall fescue (*Festuca arundinacea*) waterway, rose hedgerow waterway, rose hedgerow with unmowed fescue strip, and rose hedgerow with mowed fescue strip. Forest edges with hedgerows had greater S, A, and H than plain forest edge. Rose hedgerow waterways had higher S, A, and H than fescue waterways. Hedgerows with unmowed versus mowed fescue strips did not differ in S, A, and H. There was an unexpected nearly total lack of avian use of grass waterways, possibly due to fragmentation of this habitat. Forest edges and hedgerows with grass borders can provide important habitat heterogeneity for birds in areas of intensive agriculture, particularly for "mixed-habitat" and "edge" species.—Richard A. Lent.

29. Effects of soil and grazing on breeding birds of uncultivated upland grasslands of the northern great plains. H. A. Kantrud and R. L. Kologiski. 1982. U.S. Fish Wildl. Serv. Wildl. Res. Rep. No. 15, 33 p.—This paper reports results of a 5-year study on bird and plant species abundance and richness on 615 16–65 ha plots of lightly (n = 177), moderately (n = 241), and heavily (n = 197) grazed native rangeland on various soils in 6 states. Overall, higher ($P < 0.05$) bird species richness occurred on lightly and moderately grazed plots than on heavily grazed plots. The Horned Lark (*Eremophila alpestris*), Western Meadowlark (*Sturnella neglecta*), Chestnut-collared Longspur (*Calcarius ornatus*), and Lark Bunting (*Calamospiza melanocorys*) accounted for 70% of the total bird population on all plots regardless of grazing intensity. Higher ($P < 0.05$) bird species richness was associated with cooler soil temperatures than warmer soil temperatures and was more strongly associated with soil temperatures than with organic content or soil moisture. Optimum breeding habitat with respect to grazing intensity, vegetative composition, and soil type is presented in tabular and text form (with a review of the literature) for each of 29 species of birds.

Temporal variation of bird counts could bias some conclusions in this report since only one census was taken per plot and phenological effects were not studied.—Richard M. Zammuto.

CONSERVATION AND ENVIRONMENTAL QUALITY

(see also 9)

30. Taxonomy, distribution, population size, breeding and conservation of the White-breasted Cormorant, *Phalacrocorax carbo*, on the Southern African Coast. R. K. Brooke, J. Cooper, P. A. Shelton, and R. J. M. Crawford. 1982. Gerfaut 72:189–220.—This report deals mostly with populations of White-breasted Cormorants (*Phalacrocorax carbo lucidus*) that occur along the coast of southern Africa. The authors bring together information from visits to 58 breeding colonies of this subspecies (between 1977 and 1981), nest records, published literature, and their examination of 40 specimens. Tables illustrate (1) geographic variation in White-breasted Cormorants and (2) differences in the size of coastal and inland birds from southern Africa. (I found the use of symbols denoting statistical significance confusing and poorly explained, but the tables are otherwise clear.) Extensive appendices describe (for the first time) the plumage of each age class of *P. c. lucidus* and its 76 breeding localities on the southern African coast (also shown in a somewhat jumbled map in the text) and give detailed census data concerning the number of nest sites at these breeding localities.

The authors were unable to find a morphological character that taxonomists could use to separate coastal (marine) populations of White-breasted Cormorants and fresh-water populations from the interior of Africa into distinct subspecies. Coastal birds have longer legs, shorter tails, and greater mass than inland cormorants, but these may be nothing more than adaptations for foraging at sea. Coastal birds also have a distinctly pink or pale rufous breast, but so do birds from the interior, contrary to the reports of European workers. The color is most obvious in fresh nuptial plumage and disappears when the feathers are exposed to sun, water, and wear. Inland birds with dark breasts that have previously been regarded as *P. c. gutturalis* and *P. c. patricki* are *not* subspecifically distinct from *P. c. lucidus* with which they readily form mixed pairs. The authors conclude (as have other investigators) that all subsaharan populations of *P. carbo,* even with their disjunct distribution, belong to one subspecies.

The breeding distribution of coastal populations of the White-breasted Cormorant in southern Africa is between Cunene River estuary on the border of Angola and South

West Africa/Namibia (17°15′S latitude) and Morgan Bay, eastern Cape, South Africa (32°44′S). Nonbreeding cormorants occur along the entire southern African coastline. Birds from these coastal populations do not wander more than 10 km offshore; and rarely more than 55 km inland. The coastal breeding population numbers 2524 pairs which are more heavily concentrated in South West Africa/Namibia than in South Africa. Most of them breed on the Atlantic, rather than the Indian Ocean side of the continent. Coastal birds breed year round, with egg-laying peaks in summer and winter, in sharp contrast to cormorants from the interior which do not breed in the summer. They readily use artificial structures for nest sites, including pylons, the masts and superstructures of wrecked ships, and scaffolding on guano platforms. Nest densities may be as low as one or as high as 700 per colony. Those on the Indian Ocean are generally smaller than those along the Atlantic. Clutch size is 2–4 eggs, the median being 3 as it is inland, but coastal pairs rarely rear more than 2 young.

White-breasted Cormorants are not in danger of extinction, but it is difficult to delineate population trends for them because of the ephemeral nature of many of their breeding areas. They are, however, unusually sensitive to human disturbance compared to other cormorants and when disturbed flush more readily and return more hesitantly to their nests. Consequently, their clutches and chicks are more vulnerable to predation from Kelp Gulls (*Larus dominicanus*; which are always in cormorant breeding colonies) than those of their congeners. The authors recommend that the breeding localities of White-breasted Cormorants be accorded additional protection from human intrusion.—Michael D. Kern.

31. Raising Bearded Vultures in zoos (Borodacha razvodiat v zooparke). V. A. Ostapenko and R. P. Ignat'ev. 1982. Priroda (Mosc) 9:75–77. (Russian.)—Since 1975 the Moscow Zoo has had a pair of Bearded Vultures (*Gypaetus barbatus*) which courted, built nests, mated, laid eggs, and incubated, but no surviving offspring resulted. In 1980, the Zoo moved its large raptors into spacious cages with artificial cliffs. Here the Bearded Vultures promptly built a nest. In 1981 the female laid 2 eggs, and in 1982 she laid one. All 3 were sent to West German raptor specialist, E. Luttger, and all hatched under his care. One of the 1981 birds has been sent to Vienna, to aid efforts to reintroduce the species in the Alps; its sibling was returned to Moscow.—Elizabeth C. Anderson.

PARASITES AND DISEASES

32. The ecology of tick parasitism on densely nesting Peruvian seabirds. D. C. Duffy. 1983. Ecology 64:110–119.—Nest desertion is common among each of the 3 main species of birds nesting on the "guano islands" of Peru: The Guanay Cormorant (*Phalacrocorax bougainvillii*), the Peruvian Booby (*Sula variegata*), and the Peruvian Brown Pelican (*Pelecanus occidentalis thagus*). Duffy presents evidence that ticks are the principal cause of nest desertion. His work on 9 islands showed that adult birds attending nests that are subsequently deserted averaged significantly more time per minute preening than did birds nesting in areas where the nests were never deserted. The assumption here is that preening is done at least in part to eliminate ectoparasites. Duffy also found a significant rank correlation between percent desertion and density of ticks in samples of guano and debris taken from nests. While this amount of evidence is not overwhelming by itself, when combined with a most thorough presentation of all imaginable alternative explanations for the nest desertions and counterevidence for each of these alternatives, Duffy's case that ticks are the causative factor for the desertions becomes quite strong. In fact, I might have been ready to praise Duffy's presentation of alternative explanations as exemplary were it not for an annoying redundancy in the results and discussion sections. For instance, identical parenthetical figure references referring to the above mentioned correlation appear in both the results and discussion. On the positive side again, Duffy finishes his discussion with a tabular presentation of 46 reports from the literature on tick outbreaks and their effects, if reported, for various primarily colonial nesting birds. Duffy's point, again well-accomplished and worth remembering, is that ectoparasites, like predators and competitors, need to be considered seriously relative to many aspects of the breeding biology of birds.—A. John Gatz, Jr.

33. On the invertebrate fauna of Eastern Bluebird nests. W. Chow, E. H. Burtt, Jr., and D. E. Johnson. 1983. Sialia 5:53–57.—Thirteen nests of Eastern Bluebirds (*Sialia sialis*) were examined for invertebrates. After the birds had left the nest, all invertebrates were collected, identified to family, and counted. Specimens of mites were sent to Ohio State University for species identification. The invertebrates included one family of spiders, 2 families of mites, and 11 families of insects. One parasitic species of mite (*Dermanysses hirundinus*), was present in all nests and in sufficient numbers to potentially affect nestlings. One detritivorous species of mite (*Dermatophagoides evansi*), was also found in all nests. The occurrence of both mites was positively correlated with brood size. Predaceous invertebrates included jumping spiders and two families of insects. The limiting factor in the nest ecosystem appears to be dispersal in all cases except that of the mites, which were limited by food supply. Of the species reported in this study, all had been previously reported from bluebird nests except the parasitic mite, *D. hirundinus.* Nestlings were not studied for potential detrimental effects of the mites, but the large number of mites suggests a possible effect on nestling weight. Nonetheless all nestlings fledged.—Kimberly Counihan.

PHYSIOLOGY

(see also 1, 36)

34. Changes in physical condition of male Mallards (*Anas platyrhynchos*) during moult. D. A. Young and D. A. Boag. 1982. Can. J. Zool. 60:3220–3226.—Several not too surprising (at least with 20/20 hindsight), but nonetheless interesting changes in body physiology are documented in this study of 130 year-old male Mallards. Leg muscle mass showed a significant increase (16%) during the first flightless period of the molt, a period when swimming is suddenly the predominant mode of locomotion. Pectoral muscle mass showed a corresponding decrease (17%) at this same time. Body lipids in general decreased during the molt, but not so low as the levels found during other periods of stress. Lipids in the pectoral muscles decreased insignificantly; there was no evidence of these lipids being used as energy reserves as would be the case during starvation. Lipids in the skin increased during the initial molt, an increase which would make sense if the cutaneous fat were being used as a temporary alternative to feathers for insulation during the molt. Overall, the Mallards, in this one year at least, came through their molt with only minor physiological changes and no evidence of nutritional stress.—A. John Gatz, Jr.

MORPHOLOGY AND ANATOMY

(see also 30, 41, 46)

35. A quantitative method for age determination of adult birds. F. J. Jannett, Jr. 1983. Am. Midl. Nat. 109:145–151.—Avian population studies would be greatly enhanced by a good technique for classifying the ages of adult birds. Jannett suggests that differential growth of bones might provide a means for identifying adult White Leghorn chickens. He tested this hypothesis with material from 152 chickens of 2 adult age cohorts (2.25 and 3.25 yr). Weights of the patellae, leg tendon splints, skull, mandible, scapulae, coracoids, furcula, sternum, radii, ulnae, humeri, pelvis, femora, tibiotarsus, and tarsometatarsus plus the weights of dried eye lens were used as variables. Discriminant analysis with log transformations of the data from females yielded a canonical correlation of 0.8498 and subsequent 91% correct classification to age class. Data from males with multiplicative indices gave similar results. Since we don't know the effect of artificial selection on bone growth in chickens, it would be valuable to repeat this technique with wild species having age-specific plumage characteristics.—J. M. Wunderle, Jr.

36. Studies in Willow Grouse *Lagopus lagopus* of some possible measures of condition in birds. R. Brittas and V. Marcstrom. 1982. Ornis Fenn. 59:157–169.—Body size, body and breast muscle weight, and fat content were studied in different age and sex classes of 256 Willow Grouse. Protein content was estimated in 51 birds. Sternal length explained up to 34% of the variability in breast muscle lean dry weight, and was a better measure of body size than was wing length. In all sex and age categories lean dry weight of breast muscle was a good predictor of total protein. Intramuscular pectoral fat was an acceptable predictor of total fat only in juvenile birds, but could be extrapolated adequately to predict condition in all the sex and age categories. Since fat and protein levels were not strongly correlated, the authors felt that both must be studied to assess condition adequately in Willow Grouse.—Lise A. Hanners.

37. On the phylogenetic relations between divers (Gaviiformes) and grebes (Podicipediformes) (K voprosu o filogeneticheskikh vzaimootnosheniiakh mezhdu gagarami (Gaviiformes) i pogankami (Podicipediformes)). L. P. Korzun. 1981. Zool. Zh. 50:1523–1532. (Russian: English summary.)—Previous research examining the extremities of fossil loons and grebes indicated that modern loons and grebes are not descended from a common ancestor, but rather that their ancestors were different even before both kinds of bird began to keep less to marshes and more to open water. Korzun has provided further corroboration by a morpho-functional analysis of the hyoid and jaw apparatus of recent species of loons and grebes, based on the assumption that the capability to eat on the water, where there is no place to set down food, had to be developed before the prehistoric birds could leave the land.

Ancestral loons, presumably predators, could put a food item on the ground and hold it with a foot while dismembering it with strong blows of a sharp beak or pulling it apart so that it could be swallowed. Before becoming swimming predators, unable to steady their prey on a hard substrate while dispatching and consuming it, the birds had to be able to swallow whole crustaceans, amphibians, etc. Other birds like waders solved this problem by developing "active stretching" of the lower mandible. Loons did not, but "passive bending" of the ramus of the lower mandible was possible. Natural selection seems to have favored larger prehistoric loons, not only because they could swallow larger prey, but also because they could swim faster underwater in pursuit of fish.

However, loon chicks cannot cope with large food items, and must be supplied with things like small invertebrates. In contrast to other groups of birds that, like loons, developed the habit of eating in relatively large "bites," loons have retained a large tongue. The musculature of a loon's face and jaws enables it to hold a small invertebrate against its upper mandible by its tongue while conveying the food to the chick, but the musculature of a grebe's head does not provide this limberness of tongue and beak.

Since the paleontological "chronicles" of grebes are very scant and do not go so far back in time as those of loons, the Pied-billed Grebe of the Americas, probably the most primitive grebe, has been studied. Grebes feed on slower-moving aquatic prey than do loons, and they are able, with their stout short bills, to dispatch prey, pull out fish spines, and otherwise "process" food before swallowing it. But their ancestors, like those of the loons, lacked a place to set prey for dismembering. Development of the capability of "active stretching" of the mandibles allowed grebes to swallow larger items and also to catch the smaller aquatic invertebrates. A grebe sharply bends out the rami when closing its beak on an invertebrate which might escape from a more rigid mouth, and by movements of its jaws, not of its tongue, conducts the invertebrate to its gullet. Grebes have in fact no way to raise the tongue all the way to the upper mandible.

Korzun concludes that although it seems well proven that grebes and the apparently much older loons are not closely related, it would be premature to make firm statements about ties they might have to other groups like cranes until the morphology and physiology of all are better known.—Elizabeth C. Anderson.

PLUMAGES AND MOLT

(see also 8, 30, 34, 41)

38. Factors influencing timing of autumn dispersal or migration in first-year Dunnocks and Whitethroats. 1983. Bird Study 30:39–46.—Juvenile Dunnocks (*Prunella madularis*) and Whitethroats (*Sylvia communis*) captured just before or in the first stages of pre-basic molt remained in the study area longer than birds first caught in later stages of molt. Mean body weights of resident Dunnocks increased during early molt, peaked at mid-molt, and then dropped as molt was completed. The migratory Whitethroats increased in weight just prior to their migration in September, irrespective of their stage of molt.—Stephen R. Patton.

ZOOGEOGRAPHY AND DISTRIBUTION

(see also 40, 41, 43)

39. Exotic *Calidris* species of the Siberian tundra. J. P. Myers, O. Hilden, and P. Tomkovich. 1982. Ornis Fenn. 59:175–182.—This paper provides short descriptive texts and photographs of Siberian sandpipers on their breeding grounds. Seven *Calidris* species are presented: *C. ptilocnemis, C. bairdii, C. mauri, C. acuminata, C. tenuirostris, C. subminuta,* and *C. ruficollis.* These interesting species accounts provide basic information on the distribution, habitat, density, display, mating system, nesting, and migration of these sandpipers.—Lise A. Hanners.

SYSTEMATICS AND PALEONTOLOGY

(see also 5, 30, 37, 43)

40. The biology and taxonomy of Townsend's Shearwater. J. R. Jehl, Jr. 1982. Gerfaut 72:121–135.—Jehl summarizes the published literature concerning Townsend's Shearwater (*Puffinus a. auricularis*) and provides additional notes about the species from recent trips to their breeding areas in 1978 and 1981. Nonetheless, the details of this Shearwater's natural history are still sketchy. Topics in the paper include the birds' distribution, molt, feeding behavior, breeding season, key taxonomic characteristics, and relationships with other members of Murphy's *Puffinus puffinus* complex. There are illustrations of live birds and museum specimens, notes concerning the morphology and plumage of the small black-and-white shearwaters of the eastern tropical Pacific, and sonograms of flight calls of Newell's (*P. a. newelli*) and Manx (*P. p. puffinus*) shearwaters.

Townsend's Shearwater occurs in a narrow band of latitudes (11° to 23°N) around the Revillagigedo Islands where it breeds and the coast of Mexico where it spends at least part of the off-season. Breeding is probably now restricted to Clarion and especially Socorro islands in the Revillagigedo group, although it was more extensive historically. Shearwaters gather at these islands in mid-November; lay eggs in January; and fledge young between late May and July. Thereafter, they disperse widely (some as early as April) and do not begin to appear in the coastal water off the Mexican mainland until early fall. Molt of the body feathers occurs on the breeding grounds, but the flight feathers are not renewed until the birds reach the coast. Feeding behavior is like that of other shearwaters: the birds cruise low to the water and settle at sites of food; they feed at or near the surface. The white flank patches that extend onto the sides of the rump, as well as dark undertail coverts, are particularly useful for identifying Townsend's Shearwater in the field.

The taxonomic relationships of the shearwaters in the *Puffinus puffinus* complex should be critically reviewed. In this regard, differences in their vocalizations may be more important than differences in their morphology. The evidence at hand suggests that *opisthomelas, gavia, huttoni,* and *auricularis* are distinct species and that *newelli* is a race of *auricularis.*—Michael D. Kern.

41. Geographical variation of the Kittiwake, *Rissa tridactyla*. R. Sluys. 1982. Gerfaut 72:221–230.—On the basis of detailed biometric studies, R. Sluys suggests that it is unwarranted for ornithologists to recognize 2 subspecies of the Kittiwake (i.e., *Rissa t. tridactyla* and *R. t. pollicaris*).

He examined breeding birds (museum specimens) of both sexes from 10 representative and widely separated localities including Greenland, Iceland, Norway, the Faeroes Islands, British Isles, and the Bering Sea. He measured 10 characters (wing, tail, and tarsus length; length of middle toe, bill, nalopsi, and gonys; depth of bill at base and angle; and sum of length of black marks on primaries 8–10) on each of 2–22 males and 0–9 females from each locality. He uses range maps to show geographical variations in 9 of these characters.

Male kittiwakes were generally larger than females, but within each sex mean values of characters differed significantly from one locality to another and did not always vary in the same directions between the sexes. In most respects, kittiwakes from western Greenland and Britain had the smallest means; among Atlantic samples, birds from Spitsbergen and Bear Island often had the largest ones. The largest specimens were from the Bering Sea. However, they were not significantly different in all measurements from Atlantic kittiwakes. Furthermore, populations in the Atlantic were not biometrically uniform. They differed significantly in wing length (males and females); bill and tail size (males only); and the length of middle toe, tarsus, culmen, and nalopsi (females only).

There were also clinal variations in several characters. Birds from the western part of the range had smaller wings, tail, and culmen, and less black on primaries 8–10 than birds from the eastern part of the range. Wings (both sexes), middle toe (females only), and bill (males only) were smaller in the south than in the north. Such clinal variations in particular argue against splitting kittiwakes into 2 subspecies.—Michael D. Kern.

42. Size, form and habit of the extinct Maltese Swan, *Cygnus falconeri*. 1982. E. M. Northcote. Ibis 124:148–158.—Comparisons of fossilized remains of foot and cranium of the extinct Maltese Swan with bones of Mute and Whooper swans indicate that the body form of the Maltese Swan was somewhat similar to, but larger than, the Whooper Swan. Allometric equations and McMahon's theory of elastic similarity are used to estimate approximate body mass (16.38 kg) and wing span (2.93 m). Since the body mass of the largest living species capable of flight averages about 12 kg, the author suspects that Maltese Swans were flightless. The structure of the foot and the small area available to the salt gland suggest that this species was adapted for terrestrial locomotion and foraged on land plants.—Cynthia Carey.

EVOLUTION AND GENETICS

(see also 52)

43. On the evolution of *Garrulax* (Timaliinae), with comparative studies of the species found at the center and those in the periphery of the distributional range of the genus. Z. X. Zheng (T. H. Cheng). 1982. Acta Zool. Sin. 28:205–210. (Chinese: English summary.)—This article represents a preliminary attempt to determine the phylogenetic relationships of the 33 *Garrulax* species (46 species world-wide) that occur in China. The genus is particularly well-represented in the center of its distributional range (western parts of Sichuan and Yunnan), where 26 species have been recorded. The high species richness and the high degree of endemism of *Garrulax* in this region are attributed to the occurrence of many different life zones and habitat types (which presumably provide ample opportunities for the geographic isolation of populations). This combination of circumstances has prompted earlier workers to propose that this region is the place of generic origin.

Six criteria were used to diagnose the "state of evolutionary development" of these *Garrulax* species. Each criterion was scaled from "+" to "+++," with "+" assigned to the less evolved state, "++" assigned to the intermediate state, and "+++" assigned to the most highly evolved state. These criteria included body size (♂ wing length > 120 mm = +++, ≤95 mm = +), plumage (showy = +++, dull = +), nostril (not covered = +++, covered = +), tip of bill (distinctly notched = +++, not notched = +), extent of range (widely distributed = +++, limited distribution = +), and number of subspecies (>6 = +++, 1–2 = +). Species with a cumulative score of 12 or more "+"'s for the 6 criteria were considered to be at a high level of evolutionary development. However, no rationale was given for the polarity of the criteria or why this particular combination of morphological and zoogeographical characters was especially appropriate for investigating the phylogeny of *Garrulax*.

On the basis of this rather unconventional phylogenetic analysis, *Garrulax* species occurring in Sichuan and Yunnan have cumulative scores of 10 or more "+"'s whereas species occurring at the periphery of the genus' range have fewer than 10 "+"'s. This pattern is contrary to the "traditional" suggestion that the range of [primitive] species usually indicates the "center of dispersal of the genus." The author interprets the observed pattern to be a result of competitive exclusion of the [primitive] species by the [advanced] species from the center of the genus' range.—Marina Wong.

44. Evolutionary genetics of birds. V. Genetic distances within Mimidae (mimic thrushes) and Vireonidae (vireos). J. C. Avise, C. F. Aquadro, and J. C. Patton. 1982. Biochem. Genet. 20:95–104.—Starch-gel electrophoresis and specific isozyme staining were used to examine the extent of genetic variation in 5 species each of vireos and mimids. Levels of genic heterozygosity and differentiation generally were found to be in the same range as those of other birds that have been examined; however, some of the genic distances within the genus *Vireo* were larger than other reported avian intrageneric distances. As the authors suggest, this result may indicate that species of *Vireo* are older than are many of the other species of birds so far studied. More vireos, especially tropical species, need to be examined.—George F. Barrowclough.

45. Serum proteins of selected Falconiformes and Strigiformes. J. A. Mosher, R. P. Morgan II, W. L. Goodfellow, Jr., E. A. Haug, and T. C. Erdman. 1982. Biochem. Syst. Ecol. 10:373–376.—Serum samples from the blood of several hawks and owls were subjected to electrophoresis and general protein staining. Similarities of patterns across species were evaluated with a matching coefficient; these values were then clustered in order to obtain an estimate of relationships. Unfortunately, in spite of the quantitative methodology, the analysis of general protein staining patterns continues to suffer from the difficult problem of homology that plagued studies of egg white proteins in the 1960's. That problem has been obviated to a great extent by the current widespread use of specific isozyme staining. Thus, for example, the suggestion that the genus *Buteo* may be polyphyletic could be the result of either a real taxonomic problem, or of difficulties in interpretation of the electrophoretic results. In either case, a more exhaustive examination of species is essential, and more up-to-date biochemical methods ought to be employed.—George F. Barrowclough.

46. Variation in the size and shape of introduced Starlings, *Sturnus vulgaris* (Aves: Sturninae), in New Zealand. H. A. Ross and A. J. Baker. 1982. Can. J. Zool. 60:3316–3325.—This is one of several studies (Baker and Moeed, Can. J. Zool. 57:570–584, 1979 and Baker, Evolution 34:638–653, 1980) Baker has done on morphological variation of birds introduced into New Zealand. An unknown number of reasonably large (>100 individuals) populations of Starlings were introduced at each of at least 5 release points in the 1860's and 1870's. With but few exceptions, e.g., variation in bill size variables relating to winter temperature and altitude, most of the variation was quite haphazard and very different between males and females. Some of the slight pattern of variation may be the result of intersexual competition. Latitudinal patterns of variation previously found in the Common Myna and House Sparrow in New Zealand were not seen in Starlings. Ross and Baker suggest that the pattern (or absence of pattern) seen in the variation of Starlings might be the combined result of the number and size of the founding populations and the presence of weaker selective forces for Starlings than other species in New Zealand or than other Starlings in North America.—A. John Gatz, Jr.

47. The evolutionary implications of chromosome banding pattern homologies in the bird order Galliformes. A. D. Stock and T. D. Bunch. 1982. Cytogenet. Cell Genet. 34:136–148.—G and C banding studies were used to obtain detailed karyotypes for 9 species of gallinaceous birds, including a cracid, guineafowl, pheasant, grouse, turkey, and old and new world quails. These banding techniques make it possible to study mechanisms of karyotypic change: for example, specific inversions, fusions, and fissions of chromosomes were identified in these galliform lineages. Most of these changes were found only in single taxa (i.e., are unique derived character states) and hence are of no value in the inference of phylogenies. However, shared derived states did identify two monophyletic clades conflicting with traditional taxonomy.—George F. Barrowclough.

FOOD AND FEEDING

(see also 12, 18, 19, 23, 26, 37)

48. Seasonal changes in the hunting behaviour of Kestrels. A. Village. 1983. Ardea 71:117–124.—The hunting activity and methods used by the Kestrel (*Falco tinnunculus*) change from mainly perch-hunting in winter to flight-hunting in summer. Amount of hunting done on the wing in non-breeding seasons was positively correlated with wind speed. The author suggests that the use of perches in winter is advantageous because it saves energy when nutritional demands are low. However, he does not present any data from kestrels using both hunting modes to support his proposal.—Clayton M. White.

49. 'Sap-sucking' by woodpeckers in Britain. J. N. Gibbs. 1983. Br. Birds 76:109–117.—Is the functional significance of tree-ringing by woodpeckers (Picidae) to obtain sap? In England, Great Spotted Woodpeckers *Picoides major* are most commonly implicated in ringing of lime, elm, sycamores, and oaks. Ringing of sycamores takes place during dormancy, while ringing on oaks and elms takes place in summer. Gibbs speculates that woodpeckers have learned that xylem sap of sycamores may be a source of moisture when open water may be frozen.—Patricia Adair Gowaty.

50. Foods selected by Blue Grouse (*Dendragapus obscurus fuliginosus*). R. D. King and J. F. Bendell. 1982. Can. J. Zool. 60:3268–3281.—The purpose of this research was to detail the food habits of Blue Grouse on Vancouver Island. Crops from 811 birds collected "incidentally" during the springs and summers of 10 yr were analyzed. Great differences were seen both between seasons and among males, females, and chicks. Males switched from mostly Douglas-fir needles in spring to berries and flowers in summer; females started on a mixture of willow leaves and needles and switched to flowers (before males) and berries; and chicks fed heavily on insects for their first 2 months before switching to berries and flowers. Overall, selectivity for plant species was quite high: 9 species accounted for >80% of the vegetation eaten with 37 species being included in the other <20% of the food taken. Forage ratios calculated using line transect and quadrat data identified which species of plants were taken at random, which were selected for, and which were selected against. The authors also present analyses of the nutrient contents of foods taken and foods available but not taken. As they point out, such information cannot conclusively show whether or not selection is based on nutrients, let alone which one or ones of the several nutrients which vary between foods eaten and foods rejected (e.g., fat, ash, nitrogen, and potassium) might have led to the selection. Still, the circumstantial evidence indicates that nutrient-based selection is a reasonable assumption. Further, a comparison of nutrients taken with nutrients consumed by other tetraonids indicates a potential nutrient deficiency in the diet of these Blue Grouse.—A. John Gatz, Jr.

51. Competition between Hermit Hummingbirds Phaethorninae and insects for nectar in a Costa Rican rain forest. F. B. Gill, A. L. Mack, and R. T. Ray. 1982. Ibis 124:44–49.—The co-evolution of plants and their pollinators has been the subject of intensive research in the past 2 decades. This paper details competitive interactions for nectar between pollinators, several species of Hermit Hummingbirds, and "thieves," stingless bees, *Trigona.* The scarlet passion flower (*Passiflora*) provides the primary source of nectar for the hummingbirds during the dry season. The bees gather pollen and nectar by chewing into the base of the flower and decrease the foraging efficiency of the hummingbirds by chasing them away from the flowers and by reducing nectar levels in the flowers. Bees also affect the plants, since seed set is proportional to the amount of outcrossing due to pollination by hummingbirds. Therefore, the bees pose a considerable detriment both to the hummingbirds and the flowers.—Cynthia Carey.

52. Food selection in the tetraonid hybrids *Lyurus tetrix* × *Tetrao urogallus, Lyurus tetrix* × *Lagopus lagopus* and *Tetrao urogallus* × *Lagopus lagopus.* E. Pulliainen. 1982. Ornis Fenn. 59:170–174.—The crop and gizzard contents of 12 tetraonid hybrids were identified. Two of 6 specimens of *Tetrao tetrix* × *T. urogallus* had eaten pine needles, the typical food of *urogallus*; 3 of 6 had eaten food typical of *tetrix*, and one specimen had eaten both types of food. Similar data were obtained for the 4 specimens of the second hybrid and 2 specimens of the third hybrid. Pulliainen's conclusion was that such data provide clues to the inheritance of food selection patterns in gallinaceous birds. While small sample sizes may be an unavoidable problem with hybrid studies, data on food availability at the collection localities should be presented. These data were insufficient to demonstrate feeding preferences of the hybrids.—Lise A. Hanners.

SONGS AND VOCALIZATIONS

(see also 10)

53. Alerting and message components in song of Rufous-sided Towhees. D. G. Richards. 1981. Behaviour 76:223–249.—Bird songs are degraded when sound waves are changed by wind, foliage, and interaction with other bird songs. This study of the Rufous-sided Towhee (*Pipilo erythrophthalmus*) investigated "song structures facilitating detection and recognition over distance." From 1976 to 1978 different towhee songs were recorded with each song varying from a strong, clear sound (as if sung from close by) to a faint, slurred sound (as if sung from far away). Territories were mapped in the area where the recordings were made. Songs that were both normal and degraded were played to each male towhee in the middle of his territory. During the playback experiments, response intensity was measured by flight and rapid calling or singing in the vicinity of the speaker. When the degraded introduction and trill were played separately, response scores of the towhees were very low, but, when the degraded introduction and trill were combined, the towhees' responses were similar to those of the normal full song. This suggests that the introduction "allows recognition of the trill at a distance or under adverse acoustic conditions." This paper provides a concise picture of the cues critical to signal detection by towhees over long distances. Several sound spectrograms illustrate the effects of degradation on the towhee song.—Jenny M. Turner.

54. The role of silences and elements in the recognition of a dialect in the Corn Bunting. M. Pellerin. 1982. Behaviour 81:287–295.—The hypothesis that the physical parameters of song recognition in species, are similarly employed in dialect recognition, was tested in this study. To determine the physical parameters of dialect recognition, the Corn Bunting, *Emberiza calandia,* was used because it has local dialects and responds weakly to foreign dialects. The study was carried out in an area of 4200 ha occupied by 156 territorial males having the same dialect. A microprocesser was used to create a synthetic song from one of the 3 songs in the birds' repertoire, and also to make 10 variations of the song, each with one alteration. To measure the buntings' response, 5 classes of behavior were used ranging from Class 0: no response, to Class 4: strong response with singing and nose-dives over the speaker. For each experiment, the test song was played first, and then the control, each for 20 min. Statistical analysis by the Sign Test showed that in 6 of the 10 trials, there was a significant difference between the birds response to the manipulated song and the control song. Pellerin concluded that the presence of the motifs, the wholeness of each motif, and exact form of the elements were not absolutely necessary for recognition, and that recognition of the Claville dialect depends on both the temporal distribution of silences and elements of the song, in other words, the syntax of the song.—Fred Roberts.

55. Song development in Chaffinches: what is learnt and when? P. J. B. Slater and S. A. Ince. 1982. Ibis 124:21–26.—One of the necessary prerequisites for understanding the relation of avian song to reproductive success involves determining whether population-specific songs are learned during the nestling period from the chick's father or during the first breeding year from territorial birds. This study evaluated when song learning takes place in Chaffinches (*Fringilla coelebs*), which have only a rudimentary ability to sing a species-specific song if acoustically isolated throughout development. The elements of song of males in their first breeding year were compared with those of males on adjacent territories to evaluate if learning takes place after the establishment of territories. Since the similarity of songs was no greater than expected by chance, it was concluded that some components of song had been acquired prior to territory establishment. Results of learning trials on 2 hand-reared birds confirmed that some elements of song could be learned during the nestling and fledgling stages.—Cynthia Carey.

BOOKS AND MONOGRAPHS

56. Avian incubation: egg temperature, nest humidity, and behavioral thermoregulation in a hot environment. G. S. Grant. 1982. Ornithol. Monogr. No. 30. 75 p.—Several species of charadriiformes and a nighthawk nest successfully at the Salton Sea (a man-made saline lake in southeastern California), a xeric area in which there is virtually no cloud cover or rainfall in the summer, and in which solar radiation is intense, ground temperatures exceed 50°C, and air temperatures approach 38°C on a regular basis. This monograph explains how these birds manage under such inhospitable conditions. It deals specifically with the breeding biology of the Lesser Nighthawk (*Chordeiles acutipennis*), and 7 charadriiformes—the Black-necked Stilt (*Himantopus mexicanus*), American Avocet (*Recurvirostra americana*), Snowy Plover (*Charadrius alexandrinus*), Killdeer (*C. vociferus*), Gull-billed Tern (*Gelochelidon nilotica*), Forster's Tern (*Sterna forsteri*), and Black Skimmer (*Rynchops niger*).

The scope of the monograph is impressive. Among other things, there are detailed measurements of the microclimate of the nest and its environs, extensive observations of nesting birds of each species, physical properties of their eggs, and experiments designed to either test specific hypotheses concerning the birds' thermoregulatory behavior or to estimate the heat load typically experienced by eggs and chicks. The text is well-written and illustrated, although the quality of the figures is variable. The literature cited is both extensive and current.

Birds that nest at the Salton Sea face 3 major problems. They must keep their eggs at temperatures compatible with embryonic development, not an easy task given the rate at which eggs accumulate heat when exposed to the sun. They must also keep their own body temperatures within physiological limits while incubating in open nests exposed to the sun. And, they must regulate the humidity of the nest. How they regulate nest humidity is still a mystery, but Grant amply shows how they solve the first 2 problems.

Adults prevent their eggs from overheating by covering them almost continuously, especially during the heat of the day. Female nighthawks, for example, stay on the nest without relief from early morning until dusk. Male and female charadriiformes share incubation duties and periodically spell one another at the nest during the day (and, by the way, at night), but they too are on the eggs virtually all of the time, relieving one another quickly. They also periodically wet the nest with water. (They do not, however, cover the eggs with nest material or bury them, as do charadriiformes elsewhere, and Grant shows rather elegantly that to do so would be maladaptive.) Such behavior is necessary if the eggs are to remain viable since egg temperature rises to nearly 50°C if the parents leave the nest untended for as little as 1–2 min on a hot day.

Adults on eggs regulate their body temperature in several ways. They make frequent, brief trips to the lake to wade while tending the eggs or at nest relief. They also typically pant or gular flutter; erect the feathers on the dorsum; orient with respect to the sun or the wind; and sit tightly or loosely or simply shade the clutch. Nighthawks exploit shadows, even moving their eggs near vegetation to take advantage of them. Charadriiformes belly-soak, returning to the nest with wet ventral plumage.

Belly-soaking is characteristic of all of the charadriiformes that Grant studied at the Salton Sea. Not only does it apparently enable sitting adults to thermoregulate more effectively, but it also facilitates the evaporative cooling of the eggs and chicks and raises the humidity of the nest. Adults belly-soak frequently (up to 155 times on hot days in the case of Black-necked Stilts) and bring an astonishing volume of water to the nest as a result (as much as 3 g of water per belly-soak). Because this behavior is so frequent and involves saline water laden with silt, eggs in the nest are commonly covered with dried salt or mud. Grant shows that dried salt does not alter the physical properties or metabolism of the egg. Mud probably doesn't change its oxygen consumption either, but it does diminish its water vapor conductance, rate of water loss, and possibly its reflectivity.

Grant spent many hours trying to find the proximate stimulus that induces this belly-soaking behavior. His data suggest that it is *not* a response to high egg, nest, or air temperature; low nest or ambient vapor pressure; or high solar radiation loads on incubating birds. It may result from decreasing nest air humidity (which Grant did not test) or from a change in the adult's core temperature (which Grant did not test adequately since he examined the body temperature of only one bird).

Chicks at the Salton Sea are also subjected to considerable thermal stress, as Grant demonstrated by monitoring the temperature of a copper model of a stilt chick in the nest. He estimates that chicks would need to use evaporative cooling mechanisms for about 10 h daily to keep from overheating. In this light, it is not surprising that they leave the nest in the early morning or late afternoon, rather than at midday, that they pant or gular flutter regularly, that charadriiform chicks frequently wade in the lake, and that nighthawk chicks seek shade during the day.

I have only touched on some of the more exciting topics covered in this monograph. There are many others that will pique the interest of generalists and specialists alike. My only criticism of Grant's project is the small size of some of his samples. A good case in point concerns his metabolic studies on stilt eggs. He measured the oxygen consumption of 2 clean eggs, 4 that were covered with mud, and 3 that were covered with salt; found no major differences among them; and concluded that mud and salt do not interfere with their metabolism. I wonder if the apparent similarity in the gas exchange of these eggs is spurious and related to small sample size. The data in several other parts of Grant's study are also noticeably limited. For example, the number of all-day observations that he made at nests of birds other than stilts—only 2–5; his values for the physical properties of eggs—based on only 1–4 eggs in some cases; and his study of the adult's ability to maintain the temperature of abnormally large clutches—he used only 2 enlarged clutches. Under these circumstances, some of his conclusions should perhaps be viewed as tentative.—Michael D. Kern.

57. The Kirtland's Warbler (*Dendroica kirtlandii*) an annotated bibliography 1852–1980. K. R. Huber. 1982. Museum of Zoology, University of Michigan, Ann Arbor. 114 p. Softcover. $5.00.—For anyone studying the Kirtland's Warbler there is only one indispensable reference. This is it. I cannot say enough in praise of it. This is the first annotated bibliography of the species to be published, and the notes are important because many of the sources are not to be found in most library collections. A particularly valuable feature is the index, which classifies the listings by subject (banding, behavior, description, eggs, food, habitat, illustrations, management efforts, nest, regional records, song, wintering grounds, and many more).

This work was extensively researched and meticulously compiled by a professional librarian with training in biology. The entries number about 800, including separate listings for multiple authors. Evidence of its thoroughness is to be found in the many references without Kirtland's Warbler in the titles and also in the more than 50 items by anonymous authors.

Every person interested in the Kirtland's Warbler will welcome this unpretentious little volume.—Harold F. Mayfield.