RECENT LITERATURE

Edited by Edward H. Burtt, Jr.

BANDING AND LONGEVITY

(see also 18)

1. Timing of completion of skull pneumatization of the Black-capped Chickadee and the Red-breasted Nuthatch. R. P. Yunick. 1980. N. Am. Bird Band. 5:43–46.—The percentage of Black-capped Chickadees (*Parus atricapillus*) with incomplete skull pneumatization was plotted against intervals of monthly thirds and subjected to regression analysis. All birds (186 captures) were banded at a feeding station near Corinth, Saratoga County, New York. Data were gathered between 26 Oct. 1975 and 2 Feb. 1980 with the bulk recorded in the winter of 1977–1978. The first banding period was 11–20 Oct. and the last was 21–31 Dec. The linear regression line equation was: Immature Percentage = 77.0 − 11.4 times the Banding Period, with an index of fit equal to 0.9694. The first completely pneumatized skull was observed 26 Oct.–1 Nov. (predicted date was 1–10 Oct.) and the last 18–31 Dec. (predicted dates 21–31 Dec.). In this species skull pneumatization begins completion in early Oct. (at about 16 weeks of age) and continues over a 14-week period. Most are 20–21 weeks old when they complete the process, but one extreme case of a nearly 28-week-old was recorded. Skull examination can reliably be used to separate adults and immatures through September. From early Oct. until early Feb. incomplete pneumatization safely identifies immatures and thereafter the technique is no longer useful in determining ages. The results are comparable to some closely related Parids reported in the European literature.

In the Red-breasted Nuthatch (*Sitta canadensis*), too few captures were made to allow regression analysis. Preliminarily it seems this species initiates pneumatization early in Sep. and completes it in late Nov. or early Dec. Two cases of persistently incomplete pneumatization were recorded; one for 20 months and one for over 5½ yr.—Richard J. Clark.

2. Three long distance recoveries of banded New Jersey Barn Owls. L. J. Soucy, Jr. 1980. N. Am. Bird Band. 5:97.—The banding of 476 Barn Owls (*Tyto alba*) (436 as nestlings) has yielded 3 long distance recoveries. The birds were banded in Somerset and Hunterdon counties, New Jersey, and recovered in Alabama Port, Alabama, and Sanibel and Merritt islands, Florida. Elapsed times and respective distances were: 172 d, 1760 km; 658 d, 1760 km; and 301 d, 1488 km.—Richard J. Clark.

MIGRATION, ORIENTATION, AND HOMING

(see also 2, 61, 83)

3. Solar cues in the migratory orientation of the Savannah Sparrow, *Passerculus sandwichensis*. F. R. Moore. 1980. Anim. Behav. 28:684–704.—This paper presents the complete story of work presented earlier in preliminary form (Nature 274:154–156, 1978). Wild caught Savannah Sparrows were tested in Emlen funnels to evaluate what, if any, role is played by the sun in migratory orientation. Most of the tests involved 2 conditions: birds in funnels were allowed to view the setting sun as well as stars or were tested under stars only, with no exposure to sunset or post-sunset glow. In both spring and fall there was a clear, marked effect. The sparrows were much more likely to show oriented hopping and seasonally appropriate directionality when exposed to sunset. Birds tested under stars alone tended to show little activity in the cages and if oriented at all, often hopped in an inappropriate direction. The number of tests under stars was rather small and on many of those nights the moon was visible to the birds, a well-known disruptive factor. Nonetheless, the effect appears real and we have replicated these basic results with White-throated Sparrows (*Zonotrichia albicollis*) (Bingman and Able, Anim. Behav. 27:621–622, 1979). Tests in which Moore's birds saw sunset, but overcast ensued before stars came out, revealed orientation as good as that under sunset plus stars, suggesting that sunset information is sufficient to allow complete and appropriate migratory orientation. Similar results were obtained when opaque covers were placed over the cages to prevent the birds from seeing stars after they had viewed the sky at sunset. Further experiments revealed that seeing the sun's disc itself was not necessary. Birds exposed only to post-sunset glow oriented just as well.

These results seem to leave little role for stars in the nocturnal orientation of this species and indeed Moore concludes that sun information is necessary for orientation. I suspect that this conclusion is a bit too strong. Bingman, working in my lab, has found that hand-reared Savannah Sparrows do show oriented hopping when exposed to stars only, although they often hop very low on the funnels (activity that would be ignored if the standard methods of analysis of such funnels were employed). The results are also complicated by the fact that Savannah Sparrows have a magnetic compass as well. Not surprisingly, what this all probably means is that the sun, albeit obviously quite important in the orientation of this species, is one of several usable compass cues. This is a major study containing much more information than I have summarized here. It deserves careful reading.—Kenneth P. Able.

4. Wind direction and the species composition of autumn TV tower kills in northwest Florida. R. L. Crawford. 1980. Auk 97:892–895.—Intuition tells us that nocturnal migrants are often drifted by wind. But intuition can be wrong and most of the evidence on the question of drift versus compensation or wind direction selection is indirect. The basic problem has been that the goal of a given migrant observed visually or with radar is unknown, rendering an unambiguous interpretation of most data impossible. Crawford has analyzed 11 years of TV tower kills from WCTV in northwest Florida. Over the years during which he gathered the samples, Herbert L. Stoddard, Sr., plotted the position of each bird on a map. Because the birds lie downwind from the tower, it is possible to infer the wind direction on the night of the kill. Using two wind categories (from NE, 59 nights; from NW, 17 nights), Crawford asked whether known trans-Gulf migrant species were relatively more numerous in NE winds, Antillean migrants more numerous under NW winds. Eleven of 23 species categorized as trans-Gulf migrants were significantly more numerous under NE winds; all of 5 species of Antillean migrants were more numerous when winds blew from NW; 11 of 13 species that winter primarily in peninsular Florida were more frequent in kills under NW winds. The results thus clearly support the hypothesis that migrants select nights for migration based in large part on the wind direction relative to their known goal or direction. This is an important paper because it provides a direct and unambiguous test of the hypothesis. It would be very interesting to know other things about these samples, e.g., the age ratios of the birds involved, but those data are apparently not available.—Kenneth P. Able.

5. Short-term residence in deflector lofts alters initial orientation of homing pigeons. J. A. Waldvogel, J. B. Phillips, D. R. McCorkle, and W. T. Keeton. 1980. Behav. Ecol. Sociobiol. 7:207–211.—The deflector loft developed by Baldaccini et al. (J. Comp. Physiol. 99:177–186, 1975) to test the olfactory hypothesis of pigeon homing has usually been used as a long-term residence for the birds. Waldvogel et al. found that the predicted clockwise and counterclockwise shifts in initial orientation occurred after residence times of only 7–20 days. This means either that the putative olfactory maps of pigeons are very labile or that the deflector loft effect is due to something other than odors. Stay tuned for future installments.—Kenneth P. Able.

6. Gregarious behavior among migrating Honey Buzzards, *Pernis apivorus*. M. Thake. 1980. Ibis 122:500–505.—What is the function of flocking in Honey Buzzards and other soaring birds during long distance migration? A model is presented for flock formation which predicts that the number of birds seen on a given day should increase as the number of birds sighted increases. It further predicts that the rate of increase should decrease as the number of birds sighted increases. The model postulates that there is a conflict between the tendency to flock or to continue migration when in sight of other flocks or individuals. The conflict is expected to result in a minimum distance between flocks at different rates of migration. Thake further assumes that the accuracy of orientation in flocks is better than that of individuals. Whether birds flock or continue to migrate depends on weather conditions, physiological state of the bird and the distance and direction of nearest conspecific. Data collected at Malta during autumn migration fit the expected distributions remarkably well, but the model and test fall short of explaining how or why flocking occurs.—Paul Kerlinger.

7. Does pigeon homing depend on stimuli perceived during displacement? I. Experiments in Germany. H. G. Wallraff. 1980. J. Comp. Physiol. 139:193–201.—Three not necessarily mutually exclusive hypotheses exist to explain homing navigation in pigeons: (1) the birds maintain some sensory contact with home; (2) some sort of information gathered during the displacement journey enables route reversal or integration and calculation of the homeward direction; (3) comparison of some set of information between the home site and the release site reveals the homeward direction; no enroute information is required. Various older attempts to block sensory channels during transport (usually one modality at a time) revealed no clear effects. Recent studies from several labs have indicated influences of various manipulations during the outward journey (olfactory cues, magnetic information, outward journey detours), but the results have often been slight and inconsistent. Wallraff has made the most elaborate attempt to date to eliminate all relevant input to the pigeons during displacement. The experimental birds were transported in individual compartments in a centrifuge drum that rotated at 1.5 Hz at full speed. The sense of rotation was changed on average every 2.5 min according to a nearly random sequence. Likewise, Helmholz coils around the drum produced a horizontal magnetic field of 1.0 or 1.5 Gauss with 8 directional settings (separated by 45°) which were also varied randomly. The pigeons in this apparatus breathed bottled air. The drum was illuminated most of the time, but random 10–15 min periods of darkness were provided. Thus every attempt was made to preclude the pigeons' receiving any useful visual, olfactory, magnetic, or inertial information during outward transport. Control birds were transported in plastic crates atop the van. Both groups were held in crates at the release site where they were exposed to all local conditions. Because of the extreme treatment of the experimental birds, both groups were held for several hours or even overnight at the release site. Both experienced and inexperienced pigeons were used in releases from 14–316 km from home, mostly from the four cardinal directions. In neither initial orientation nor homing performance was there any difference between experimentals and controls. Wallraff believes that the pigeons were transported under cueless conditions and certainly no previous attempt has been nearly so elaborate. He concludes, I think justifiably, that homing ability does not depend on stimuli perceived during displacement. This does not necessarily mean, as he points out, that such information cannot be used if available. In that light, his results are not completely incompatible with the data which show displacement-dependent effects.—Kenneth P. Able.

8. Does pigeon homing depend on stimuli perceived during displacement? II. Experiments in Italy. H. G. Wallraff, A. Foà, and P. Ioalé. 1980. J. Comp. Physiol. 139:202–208.—This paper presents results of similar experiments performed with Italian pigeons housed in lofts near Pisa and Florence. The same procedures were used and in general the conclusion was the same: information perceived during the outward journey is not usually necessary for pigeon homing. The results in Italy were, however, more variable than those in Germany. Most notably, there was a trend toward reduced homeward directedness in the vanishing bearings of the experimental birds. This suggests that pigeons in Italy make more use of enroute information and/or are less able to home solely on the basis of release site stimuli, but the differences were slight.—Kenneth P. Able.

9. Olfaction and homing in pigeons: nerve-section experiments, critique, hypotheses. H. G. Wallraff. 1980. J. Comp. Physiol. 139:209–224.—The olfactory hypothesis of pigeon homing elaborated by Papi and his colleagues at Pisa has been very stimulating to the field and has generated considerable controversy (see review **14**, recent past reviews in this section, and Able, in Animal Migration, Orientation, and Navigation, S. A. Gauthreaux, ed., Academic Press, New York 1980). Most notably, Keeton's group at Cornell has been unable to replicate many of the experimental results and attributes most of the differences found to a lowered motivation to fly on the part of experimental birds rather than a basic effect on the navigational mechanism. Wallraff has presented an elaborate and detailed set of data relative to the olfactory hypothesis. Young, completely inexperienced pigeons from Würzburg were used in all tests. Experimental birds were rendered anosmic by bilateral olfactory nerve section; controls were mostly untreated. Releases were made from four cardinal points to enable evaluation of directional biases (PCD of Wallraff), at distances of about 180 km. As is usual for first flight pigeons released at such long distances, return rates were quite low. Only 19% of 171 control pigeons returned to the loft; none of the experimentals did so. There were also statistically significant differences in initial bearings: controls were homeward oriented, especially in the 1979 series; experimentals were not. However, there was large variability and this difference emerged only in pooled data. In the 1975 + 1978 series, neither group was oriented at the north and south release sites; east of the loft only controls were oriented (homeward); west of the loft only experimentals were oriented. In 1979 the results were somewhat clearer: only the controls were oriented north and east of the loft; at the other two sites both groups were oriented, but neither was homeward. An important aspect of this study was that attempts were made to recover as many of the birds as possible, even if they did not home. The recovery sites of both groups of birds (pooled data) were significantly homeward, but the experimental birds were significantly weaker; the difference is quite clear. Of importance to the interpretation of the results was the fact that no significant difference existed in the distances of the recoveries of non-homers (both groups) from the individual release sites. However, from all four sites the median recovery distance of experimentals was less than for controls (by about 40 km from three of the four directions), and when the data were pooled a significant difference ($P < .05$) emerged. While this difference is not great, it does not allow one to entirely reject Keeton's motivation hypothesis.

Taken together, the data show a considerable decrement in the homing ability of anosmic pigeons re initial orientation, vanishing interval, direction and distance of recovery from release site, and homing success. Except in the last case, however, all the differences are quantitative: anosmic pigeons did show significant movement in the home direction and as a group they flew less far from release. One could interpret these results as suggestive of a motivational deficit rather than a loss of navigational ability, especially in light of the fact that control birds were not sham-operated. As has so often been the case with this phenomenon, the strength of one's conclusions depends on which aspect of the data is deemed most important. The occurrence of effects of olfactory deprivation at distances as great as 180 km is quite surprising. Papi's original hypothesis applied only to short distances although it was later modified to include information gathered on the outward journey, thus extending its usable range. Wallraff, on the other hand, proposes that odors provide one of the two gradients in his null-axis navigation model. In support of this, he cites controls used in the 1979 experiments that were transported under "cueless conditions" as described elsewhere (see review **7**). These birds could not have picked up odors during displacement, yet oriented like open air controls. The paper contains a wealth of detailed data and analysis and is a very important contribution.—Kenneth P. Able.

10. Different migratory flight speeds of closely related bird species. [Unterschiedliche Zuggeschwindigkeit nahe verwandter Vogelarten.] W. Gatter. 1979. J. f. Ornithol. 120:221–225.—The ground speed of migrating *Fringilla c. coelebs* (a partial migrant) was 37.1 km/h (n = 170) with a 2.6 km/h head wind; while *Fringilla montifringilla* (a totally migratory species) had a migratory ground speed of 41.4 km/h (n = 96). The difference in flight speed was attributed to longer primaries in *F. montifringilla.* The faster migratory speed gives it an advantage in overcoming migratory obstacles.—Robert C. Beason.

11. Homing experiments with birds displaced from their wintering ground. S. Benvenuti and P. Ioalé. 1980. J. f. Ornithol. 121:281–286.—Robins (*Erithacus rubecula*), Blackcaps (*Sylvia atricapilla*), Wrens (*Troglodytes troglodytes*), Long-tailed Tits (*Aegithalos caudatus*), and Dunnocks (*Prunella modularis*) were displaced during fall migration and winter. Displacement distances ranged from 4.5–16 km and recapture rates of displaced individuals were compared with birds banded and released at the capture site. Sample sizes are not large. Homing success in Robins was about 30% with no obvious relationship to displacement distance. Adults were better than subadults and higher returns were obtained in winter than in autumn. At distances up to 8 km, Dunnocks had a very high homing rate (nearly 70%), whereas Wrens had a quite low rate, and no displaced Long-tailed Tits were recaptured. Blackcaps had very low recapture rates whether displaced or not, suggesting that they range over an area that was large relative to the study site. Many species of migrants are now known to be territorial both on the breeding and wintering ground, thus creating the possibility of studying homing behavior in wild birds during both seasons.—Kenneth P. Able.

12. **Further investigations on the homing behaviour of pigeons subjected to reverse wind direction at the loft.** P. Ioalé. 1980. Monit. Zool. Ital. 14:77–87.—In my opinion, some of the most convincing data relative to the olfactory hypothesis of pigeon homing have come from the fan experiments of Ioalé and colleagues. Birds were housed in the same glass corridors as in previous experiments. The corridors were aligned roughly east–west. Control birds housed in the central corridor experienced natural winds from either of these two directions. Experimentals lived in the two lateral corridors and were exposed to no natural winds. When west winds blew, the experimental birds received fan-generated winds from the east, and vice versa. Four releases more or less east of the loft (44.5–166.5 km distance) were made. Both experimentals and controls were transported in aluminum containers or wicker baskets (one release) in which they received outside air enroute. As in previous experiments, experimentals and controls vanished in nearly opposite directions (as predicted) in three releases and experimentals were deflected by about 81° from controls in the fourth. Experimentals also tended to have poorer homing performance. A new aspect of these experiments was that in three of the releases some birds were transported in iron containers which reduced the magnetic field experienced by the birds to about 1/200 of its natural value. Control birds transported in iron containers were homeward oriented in all three releases; experimentals were random in three releases, but homeward oriented in the fourth. This difference is interesting, if anomalous. Ioalé cannot clearly account for it, but some as yet unclear connection between olfactory and magnetic information seems to be suggested. More data are obviously needed.—Kenneth P. Able.

13. **A comparison of orientational and homing performances of homing pigeons of German and Italian stock raised together in Germany and Italy.** J. Kiepenheuer, N. E. Baldaccini, and E. Alleva. 1979. Monit. Zool. Ital. 13:159–171.—It has often been difficult to replicate results of homing pigeon experiments in different laboratories. To what extent this has been due to regional differences or variation in the genetic stocks of pigeons has been problematical. In this study, equal numbers of pigeons from the Tübingen and Florence lofts were interchanged and raised under similar conditions with an equal number of birds from the home loft. The domestic birds and foreign visitors were trained and tested similarly at the two sites. The experimental releases revealed both site-specific and stock-specific differences. Site differences independent of stock: birds raised at Tübingen suffered higher losses, but had higher homing speeds; birds raised in Italy had more highly concentrated initial orientation, but more landed near the release site. Stock differences independent of site: homing speed of the domestic stock was significantly higher in both Germany and Italy. Presumably, navigational cues differ in availability and efficacy in different regions. Stocks of pigeons selected by repeated homing trials in a given region probably come to rely more heavily on those cues that are most reliable in that area. The differences reported here appear real, but fortunately they are not so great as to preclude the possibility of repeating experiments done at other lofts.—Kenneth P. Able.

14. **Homing behavior of pigeons subjected to bilateral olfactory nerve section.** K. L. Hermayer and W. T. Keeton. 1979. Monit. Zool. Ital. 13:303–313.—Results are presented from 8 releases (all but one at sites unfamiliar to these young pigeons) at distances from 18–748 km from the loft. Anosmic pigeons had homeward vanishing bearings at 4 of the 8 sites (including 748 km); sham-operated controls were homeward oriented at 4 of 8 sites (not always the same sites). Thus there was no clear difference in initial orientation. However, homing success (time required and number of birds lost) was much poorer in anosmic birds. These results are typical of those obtained by Keeton's group in attempts to repeat the experiments of the Pisa group. The authors are inclined to interpret them as a re-

flection of a decreased motivation to fly on the part of the anosmic birds (see review **9**).—Kenneth P. Able.

15. Directions of visible Skylark *Alauda arvensis* migration in east central Sweden. B.-O. Stolt. 1980. Ornis Fennica 57:71–76.—Flight directions over Uppsala in spring were in two directions, ENE and NNE. Projecting these flight lines on a map suggests that the birds were heading for the two most densely populated skylark breeding areas in Finland (southwest of Turku and near Vaasa). In autumn flight directions were mainly to the S and SW but generally appeared more scattered, perhaps because the birds came from both Finland and northern Scandinavia.—Robert B. Payne.

16. Adaptedness of the Willow Tit *Parus montanus* to the migratory habit. J. Tiainen. 1980. Ornis Fennica 57:77–81.—Willow Tits in Finland are usually local residents but they sometimes undergo movements in large numbers. Wing lengths and weights were determined for samples netted in September and October in southern and eastern Finland. One sample area was thought to have held a migrating population, because flocks of 100–150 were seen, repeatedly flying towards the sea then turning back for a pine forest. One of these birds was ringed and later recaptured 560 km away (N!) four weeks later, confirming the nonresident status of the birds here. The other sample areas were thought to be of residents; four birds caught had been banded earlier as breeders. Mean wing lengths did not differ in the "migratory" and the resident tits. Mean weights were slightly less in the "migrants." In contrast, long-distant migrant birds of other species generally have large deposits of fat to fuel their flights. The author concludes that Willow Tits are not well adapted to migration, because they lack fat deposits. The data are of interest but the conclusion of a lack of adaptation does not reasonably follow from the data.—Robert B. Payne.

17. Spring hawk migration in eastern Mexico. J. M. Thiollay. 1980. Raptor Res. 14:13–20.—Migrating raptors were observed near the eastern coast of Mexico about 50 km north of Veracruz from 6 Apr.–6 May 1977. Over 250,000 migrating hawks of 16 species were counted in just 23 days as they passed along a 20 km wide path. The location of raptor concentrations shifted from day to day and even within a day from the coast inland to a mountain range and beyond. The variation was unrelated to weather variables. By the time observations were initiated raptor migration was well under way so seasonal totals should be considerably higher when a comprehensive study is undertaken. Broad-winged Hawks (*Buteo platypterus*) accounted for 77% of the hawks counted, while Turkey Vultures (*Cathartes aura*) and Swainson's Hawk (*B. swainsoni*) accounted for 10 and 6%, respectively. Thiollay speculates that he has found an eastern flyway not only for raptors, but for several million other migrants including passerines, White Pelicans (*Pelecanus erythrorhynchos*), Anhingas (*Anhinga anhinga*), and others. He further speculates that similar flyways may be found in central and western Mexico. Based on the variation in concentration locations it may be that Thiollay is observing only part of a very broad-front migration. These observations are the first systematic and quantitative observations of spring hawk migration south of the United States and fill a void in the migration literature.—Paul Kerlinger.

POPULATION DYNAMICS

(see also 21, 22, 23, 24, 31, 42)

18. Notes on the demography of a population of Great Tits *Parus major*. (Quelques données sur la structure et la dynamique d'une population de Mésanges charbonnières *P. m.*) P. Migot and F. Malher. 1978. Alauda 46:257–265. (In French with English summary)—This is an interesting year-round banding study conducted on a local population near the town of Nemours, France, since 1972. Winter captures were facilitated by extensive feeding, so mortality rates are minimum estimates. Migot and Malher present a life table based upon recaptures of a cohort banded as young birds in 1972–1973; again the estimates are minimal because of the methods used. Males live longer than females, probably because of greater mortality experienced by females during the breeding season.

The banding results apparently indicate local movements in winter in response to temperature changes. I am not as certain that their data demonstrate these movements as the authors are.—Paul B. Hamel.

19. Distorted sex ratio among small broods in a declining Capercaillie population. P. Wegge. 1980. Ornis Scand. 11:106–109.—Capercaillie (*Tetrao urogallus*) populations were censused systematically during the summer over a 10-year period in a 356 km^2 breeding area. Populations declined greatly over the first 8 years, then showed signs of an increase over the last 2 years. During the period of decline, brood sizes also decreased significantly. Paralleling the latter decrease was an increase in the ratio of females to males in broods, from 1:1 to 2:1. This change was most pronounced in broods smaller than 3. The author attributes this change to a chick survivorship bias toward females in years of low food. Because males are nearly twice the size of females at fledging in this species, their relatively high nutritional requirements make this hypothesis reasonable.

In a brief discussion of the possible adaptive value of sex-biased mortality, the author quickly concludes that group selection would have to be invoked to explain the empirical data in adaptive terms. He fails to address some of the interesting theory on selection for sex ratio bias in terms of parental fitness, which could have application in this case. He also does not consider the consequences of surplus females in the context of the polygynous breeding strategy.—Marshall A. Howe.

NESTING AND REPRODUCTION

(see also 28, 48, 50, 55, 56, 64, 82)

20. Breeding biology of the Edible-nest Swiftlet *Aerodramus fuciphagus*. N. Langham. 1980. Ibis 122:447–461.—This study describes the breeding biology of these commercially important birds. Their nests, comprised entirely of saliva secreted from enlarged sub-lingual glands, are located communally on sides of buildings in Malaysia. They breed throughout the year with a peak in laying between October and February. Small clutch sizes, slow nestling growth rates, and prolonged nestling periods are similar to other tropical species, though breeding success is lower than that of other hole-nesting birds.—Cynthia Carey.

21. Aspects of the breeding biology of the Imperial Cormorant, *Phalacrocorax atriceps*, at Marion Island. A. J. Williams and A. E. Burger. 1979. Le Gerfaut 69:407–423.—Breeding biology of the cormorants was studied over two breeding seasons at this island in the South Atlantic, with emphasis on describing egg size, clutch size, the relation of egg size and sequence in the clutch to the weight and success of the nestlings, and the survival of the young. The last egg is smallest and it hatches 3 days later than the second egg, which hatches a day after the first. The last-hatched young seldom survive to fledging and in the small sample of nests that were followed closely, the second-hatched young survived as long as 20 days in only one brood. The main sources of mortality among eggs were high seas, which washed away whole nests, and failure (for unknown reasons) of eggs to hatch. Starvation was the main cause of death among nestlings; mortality of 18 chicks was 78%. The study includes a discussion of "brood reduction strategy" with "egg weight variation, hatching asynchrony, and deferred fat storage in growing chicks as a response to the unpredictability of food supplies," but the small samples involved prevent any quantitative test of the model.—Robert B. Payne.

22. Consequences of asynchronous hatching in the breeding biology of Great Tits (*Parus major*) and Blue Tits (*Parus caeruleus*). [Brutbiologische Konsequenzen des asynchronen Schlüpfens bei Kahlmeise (*Parus major*) und Blaumeise (*Parus caeruleus*).] M. Neub. 1979. J. f. Ornithol. 120:196–214.—Studies were done in southwestern Germany using individually marked nestlings to examine the question of producing more young than can be normally reared. Asynchronous hatching occurs when incubation is initiated before the clutch is complete. In tits, the frequency of asynchronous hatching increased as the season progressed. Later hatching young became runts and had a higher mortality rate, especially in years with poor food resources. Runts in years of good food supply came up to the weight of the other nestlings by fledging. Neub interprets these data to indicate that asynchronous hatching is an adaptation to unpredictable resource levels and allows the birds to adjust the clutch size (through starvation of late hatchlings) to match the resources available at that time. However, he does not address the hypothesis that the late eggs are insurance against infertility or loss of earlier eggs.—Robert C. Beason.

23. Reproductive success of Guillemots *Uria aalge* on the island of Stora Karlsö. S. Hedgren. 1980. Ornis Fenn. 57:49–57.—A three-year study of Common Murres (Common Guillemots) in their largest breeding colony in the Baltic Sea showed an average of 0.80 chicks fledged by a breeding pair. The main loss of eggs was due to the eggs rolling off the nest ledge or into a crack where they could not be retrieved by the parents; others were broken during incubation or were deserted, and one was taken by a gull. Approximately 1.6% of chicks fledging were killed by falling from a ledge; the others made it to sea. All marked birds that returned in a following year used the same nest site as before. Pairs that bred successfully were more likely to return than pairs that did not fledge a young (95.7% vs. 79.1%). Breeding success was a little higher than in populations on Skomer Island, Wales (see review **24**), in spite of high levels of chemical pollutants (mercury, DDT, and PCB) in murres and their eggs from Stora Karlsö and low levels in the Irish Sea colonies.—Robert B. Payne.

24. Timing of breeding of Common Guillemots *Uria aalge* at Skomer Island, Wales. T. R. Birkhead. 1980. Ornis Scand. 11:142–145.—Six colonies of Common Murres (Common Guillemots) on the same island were studied over a 3-year period to compare patterns of synchrony. Because the median laying date varied among different colonies, individual colonies exhibited more synchronous patterns than the island group as a whole. Within-colony patterns of laying were all skewed, with 60–75% of first eggs occurring in the first third of the nest-initiation period. In contrast to a common pattern in seabird colonies, individual birds in different years did not necessarily begin laying at the same time relative to other birds in the colony. Within colonies there appeared to be sub-groups that exhibited more synchrony than the colony as a whole, especially those birds nesting densely on the broader cliff ledges. Two different colonies began nesting earlier in three successive years. The author interpreted this simply as annual variation in the onset of nesting. Although the sample is small, the common pattern suggests (to me) the possibility that these may be recent colonies of younger birds, which nest earlier in the year as they grow older. Little interpretation of the results is offered, considering the wealth of information and theory available on synchronous nesting in colonial species.—Marshall A. Howe.

25. Hair-catchers aid in identifying mammalian predators of ground-nesting birds. B. W. Baker. 1980. Wildl. Soc. Bull. 8:257–259.—This paper describes construction and use of 4 different traps used to capture hair of predators while the predators rob ground-nesting-bird nests. Hair-catchers were placed adjacent to 63 dummy nests full of chicken eggs in various habitats to test for their effectiveness. Hairs from mammalian nest-predators were easily identified to species at 56% of the robbed nests. Each hair-catcher costs 20 cents and takes 15 min to construct. Modifications of these hair-catcher models could be used for a variety of circumstances.—Richard M. Zammuto.

BEHAVIOR

(see also 6, 69, 73, 74, 79, 81)

26. Observations on the behavior of Giant Petrels in the Crozet Archipelago. (Observations sur le comportement des Pétrels Géants de l'Archipel Crozet.) J.-F. Voisin. 1978. Alauda 46:209–234. (In French with English and German summaries)—Voisin describes a variety of behavior patterns of *Macronectes giganteus* and *M. halli* as a preliminary ethogram of these closely related species. Particularly interesting is the virtual lack (only three known cases) of interspecific hybridization attempts between them, in spite of similarity of courtship behaviors. Voisin speculates that precopulatory isolating mechanisms involve bill color and vocalization. Individuals, usually birds coming into reproductive condition for the first time, may begin interspecific courtship that typically results (sometimes after as long as 2–3 min) in agonistic display or even battle.—Paul B. Hamel.

27. A study of radio-equipped flickers. W. C. Royall, Jr. and O. E. Bray. 1980. N. Am. Bird Band. 5:47–50.—This study extended from 18 February through 8 April 1976. Radio transmitters averaging 4.85 g were placed on 4 male Common Flickers (*Colaptes auratus*) in Lakewood, Colorado. These packages constituted from 3.2 to 3.8% of their body weights. The study periods (d), total numbers of radio fixes and home range sizes (ha) for the 4 birds are as follows: 25, 99, 101; 28, 65, 91; 28, 53, 53; and 4, 20, 48. The calculated range sizes varied with the total number of fixes but it appears the number of fixes necessary for accurate determination of home range size was approached for the first 3 birds and their home ranges did vary considerably in size. During the day no flicker was recorded as being farther than 1.4 km from its previous night roost site. Roost sites identified for 20 flicker-nights were as follows: 10 nights on buildings, 7 nights on trees and 3 nights under a concrete bridge. During the day, when not in flight, flickers were recorded on trees, poles, and other elevated sites 70 times (77%) and on ground-level sites 20 (23%) times. Telemetry, with slight modifications in the radio package, is seen to be a promising method of gathering field data on flickers in late winter and early spring.—Richard J. Clark.

28. The White-headed Duck [Belolitsaia savka]. V. I. Drobovtsev and A. I. Koshelev. 1980. Priroda 9:102–104. (In Russian)—In the USSR the White-headed Duck (*Oxyura leucocephala*) is found in the forest-steppe, steppe, and semi-desert zone of the Kazakh Republic. Here it inhabits fresh and brackish lakes where thickets of reeds and cattails alternate with open water. Some birds arrive from the wintering grounds already paired; others are still courting. The drake swims away from the duck to a distance of 5–10 m and swiftly returns in a flat pose—head pulled down to shoulders, beak pointed straight ahead, tail trailing in the water so as to leave a wake. When 0.5–1 m away from the duck, the drake abruptly halts and jerks up his tail (to the vertical or beyond) and his head on raised neck; then he begins slowly swimming around the female, who during this display sits quietly, dozes, or dives for food; both are silent. The well-hidden nest is always built near open water; the eggs are unusually large for the size of the bird, and the total weight of the clutch may be more than that of the duck who laid it. Broods keep hidden by day, feed in evenings and at night. Most or all duties of incubating and raising young are probably done by ducks, since drakes generally leave at the start of incubation to go into eclipse. The White-headed Duck is an excellent diver but must run a long distance to take off; it flies swiftly but maneuvers poorly.

Although listed in the Red Book of the USSR, it is still shot in the fall. Drainage of lakes in forest-steppe and steppe areas significantly affects its population, and in the past quarter century the numbers and range of this species have diminished.—Elizabeth C. Anderson.

ECOLOGY

(see also 25, 45, 46, 48, 58, 64, 69, 72, 77, 78, 82)

29. Microclimate in the snow burrows of Willow Grouse (*Lagopus lagopus*). K. Korhonen. 1980. Ann. Zool. Fenn. 17:5–9.—By burrowing into the snow, the Willow Grouse creates a thermally neutral environment insulated from air temperatures that commonly plunge to −39°C. The insulating properties of the burrow are independent of the size and texture of the original snow crystals, probably because of changes in the crystalline nature of the snow resulting from the grouse's activities and the temperature change in the burrow. The grouse can reduce its heat loss about 50% by burrowing, but the ultimate importance of burrowing to winter survival remains uncertain (West, Comp. Biochem. Physiol. 42A:867–876, 1972).—Edward H. Burtt, Jr.

30. Habitat distribution and species associations of land bird populations on the Åland Islands, SW Finland. Y. Haila, O. Järvinen, and R. A. Väisänen. 1980. Ann. Zool. Fenn. 17:87–106.—The Åland Islands lie in the northern Baltic between southwestern

Finland and Uppland, Sweden. In 1975 the authors conducted line transect censuses of the breeding birds on the four main islands. The authors recognized sixteen habitats following the precedent set by Palmgren (Acta Zool. Fenn. 7:1–218, 1930) during earlier work in the Åland. However cluster analysis revealed only nine major communities—rocky pine forest, moderately barren pine forest, spruce forest, luxuriant spruce forest, deciduous grove, grove meadow, sapling stand, village pasture, field—with densities that varied from 124 pairs/km² (rocky pine forest) to 925 pairs/km² (deciduous grove). Dendrogram analysis of habitat associations of different species revealed four species groups: a poorly associated group of four pine-forest species, a highly associated group of eight species that inhabited spruce forest, a third group of species that inhabited luxuriant deciduous or mixed forests, and a fourth group of species that inhabited open habitats. Abundant species tended to be found in all habitats (e.g., *Fringilla coelebs*) although several scarce species showed similar dispersion (e.g., *Picoides major*). Abundant species with narrow habitat preferences tended to occupy open or man-made habitats (e.g., *Alauda arvensis, Sturnus vulgaris*). Species diversity was correlated with vegetation structure, but, as the authors point out, lack of a predictive theory makes it difficult to interpret this correlation in causal terms. The paper is clearly written, thoughtful, and illustrated with very fine photographs of the habitats.—Edward H. Burtt, Jr.

31. Snow cover value and conifer yield in mammal and bird life in Muscovy (from the journals of Formozov). [Znachenie snezhnogo pokrova i urozhainisti khvoinykh v zhizni mlekopitaioshchikh i ptits. (po dnevikom A. N. Formozova).] V. Osmolovskaya. 1980. Byull. Mosk. Obshch. Ispyt. Prirody, Biol. Div., 85:135–148. (In Russian)—Recorded here is the abundance of winter wildlife in the Moscow environs as related to yield of spruce and birch seeds and the depth of snow cover. During 37 years of observations abundant crops of spruce and birch seeds were recorded only 11 times. In all years lacking seed yield, the birds usually abandoned the region. On the other hand, high seed yields foretold en masse appearances, for example the Redpoll (*Acanthis flammea flammea*) in 1940, 1947, 1948, 1955, 1958, and 1961. Usually the regime was sparse snowfall in early winter and heavy snows at the season's close. Seasons of shallow snows favored the blue hare and Hazel Hen (*Bonasa bonasia*) and deep snow sheltered small rodents, shrews (?), and weasels.—Leon Kelso.

32. On the ecology of Jamaican hummingbirds. [Zur Ökologie jamaikanischer Kolibriarten.] K.-L. Schumann. 1980. J. f. Ornithol. 121:71–80.—Four species of hummingbirds are year-round residents on Jamaica: *Anthracothorax mange, Mellisuga minima, Trochilus polytmus,* and *T. scitulus.* The three genera segregate by altitude and activity height within the forest. *Anthracothorax mange* is most frequent at 500 m, *M. minima* at 800 m, and *Trochilus* at 1000 m. Within the forest, *M. minima* is found below 4 m, *A. mange* above 4 m, and *Trochilus* between 2 and 6 m. Both *Trochilus* appear to have the same habitat requirements but are allopatric. This spatial segregation appears to be the result of competition for nectar resources. Schumann measured nectar production and sugar concentration in 23 species of flowers frequented by hummingbirds. Nectar production varied from 0.2 μl to 3.5 μl/h. Sugar concentration varied from 10 to 44%. Flower species which were used exclusively by hummingbirds showed a cycle of nectar production which corresponded to the birds' activity cycle, with a high peak in the morning and a second, smaller peak in the afternoon. Species frequented by both insects and hummingbirds had a fairly constant rate of nectar production.—Robert C. Beason.

33. Foraging and coexistence of spruce-woods warblers. D. H. Morse. 1980. Living Bird 18:7–25.—The author analyzes the niche partitioning of Maine's spruce-woods warblers (emphasizing Black-throated Green *Dendroica virens,* Yellow-rumped *D. coronata,* and Northern Parula *Parula americana*) the same way as MacArthur (Ecology 39:599–619, 1958) but preconditioned by 25 years of debate. Much of the data and conclusions appear in earlier works by the author.

The 15-year study was done about 100 km west of MacArthur's study site. Unlike MacArthur, Morse found that the sexes of each species also partitioned the forest while feeding. In all species, males foraged higher in the tree but used the same structural parts as females. This partitioning seems to be maintained because it keeps mates from competing with each other, aids in increasing nesting success, and/or selects for decreased predation on nesting females.

Parulas exist on all small continental shelf islands studied, the Yellow-rumped Warblers on only a few, and the Black-throated Green only where both the former 2 exist. The former 2 species foraged over a larger percentage of the tree but had smaller territories on islands when compared to the mainland. Decreases in the densities of the socially dominant Black-throated Green seemed to cause concomitant increases in the densities of many other warbler species (Northern Parula, Yellow-rumped, Yellow *D. petechia,* American Redstart *Setophaga ruticilla,* and Common Yellowthroat *Geothylpis trichas*) as if the Black-throated Green was controlling species composition and breeding densities.

Bird species diversity in the Maine spruce forest is twice that predicted by foliage height diversity/bird species diversity curves calculated from deciduous forests and grasslands. Since there was also intersexual resource partitioning in the spruce forest, in effect, bird diversity is 4 times as high there for a given diversity of foliage than in deciduous forests and grasslands.—Richard M. Zammuto.

34. The Garden Warbler *Sylvia borin* as a member of a breeding bird community. T. Solonen. 1980. Ornis Fenn. 57:58–64.—Garden Warblers are common in mixed forest in southern Finland. The author censused numbers in a 30 ha study area, estimated biomass, and roughly estimated energy consumption of this species and of the other birds. Estimates are listed by species for passerines that were summer visitors, but are lumped under "residents" for the other passerines and for nonpasserines. Garden Warblers comprised an estimated 6.0% of bird numbers, 2.4% of bird biomass, and 1.0% of bird consumption.

The stated aim of the study was to "compare different approaches in evaluating the role of a species in its environment," and the author regards the different values listed above as meeting his objective. However he did not consider other forms of life and their significance in energy flow, and it seems artificial to restrict an ecosystems study to birds, especially as R. T. Holmes and others have shown birds to be less important on an ecosystems level than other kinds of organisms. Hence the study is not of general ecological value. I suspect that the study was an offshoot of the author's more detailed studies of the population biology of the Garden Warblers.—Robert B. Payne.

35. Energy estimation of trophic relations of larks in the Caspian demidesert. [Energeticheskaya otsenka troficheskikh svyazei zhavoronkov (Alaudidae) v polypustyne prikaspiya.] V. Shiskin. 1980. Zool. Zhurn. 59:1204–1216. (In Russian with English summary)—The species particularly concerned were: *Calandrella rufescens, Melanocorypha calandra, M. leucoptera,* and *Alauda arvensis.* Larks incidental to this area and of mention were: *Calandrella cinerea, Melanocorypha yeltoniensis, Eremophila alpestris,* and *Galerida cristata.* Particular attention was given to the food of *C. rufescens,* which was minutely analyzed. Food items were compared with availability by season. Numerical and weight ratios of the diets were estimated. Insect larvae, mostly Lepidoptera, were dominant in spring succeeded by adult Orthoptera in summer. Larks' energy flow in spring was calculated as 35×10^3 kcal/km^2/d. The larks withdrew 0.5% of the absolute and 17% of the available reserve of the larvae, but had little impact on the number of larvae during this season (1975).—Leon Kelso.

WILDLIFE MANAGEMENT AND ECONOMIC ORNITHOLOGY

(see also 20, 25)

36. Cattle grazing and management of Dusky Seaside Sparrow habitat. G. L. Holder, M. K. Johnson, and J. L. Baker. 1980. Wildl. Soc. Bull. 8:105–109.—This paper reports the effects of cattle grazing on Dusky Seaside Sparrow (*Ammospiza maritima nigrescens*) habitat. The authors conclude that cattle grazing limited to 1 animal/2.5 ha should not destroy the habitat of this endangered sparrow. They recommend that controlled burning should be done on a 3-year rotation since the sparrow evolved in habitats subjected to frequent natural fires. These recommendations may be to no avail since the sparrow is now believed extinct (see review **41**).—Richard M. Zammuto.

CONSERVATION AND ENVIRONMENTAL QUALITY

(see also 28, 59, 62)

37. The Lesser Grey Shrike *Lanius minor* in France. (La Pie-grièche à Poitrine Rose *L. m.* en France.) N. LeFranc. 1978. Alauda 46:193–208. (In French with English and German summaries)—Historical information on breeding status of *Lanius minor* in France over the last 100 yr is reviewed. LeFranc credibly argues that climatic change, involving cooler, wetter summers, coupled with persistent pesticides both in France and in the African hivernal range, have been the major factors responsible for the drastic decline of these birds in the western part of their breeding range. He believes that both factors act to reduce available food for the birds. Present population estimates indicate no more than 100, and perhaps fewer than 50, breeding pairs in France. Hungarian and Romanian populations that experience a more continental climate have apparently not been so affected.—Paul B. Hamel.

38. Mercury in eggs and nestlings of the Osprey (*Pandion haliaetus*) in Finland and its bioaccumulation from fish. F. Hakkinen and E. Häsänen. 1980. Ann. Zool. Fenn. 17:131–139.—In 1972 and again in 1978 addled eggs and mantle feathers of Osprey chicks were analyzed for mercury content. The correlation between mercury content of the plumage and other parts of the body is not clear, but a large proportion of the mercury load appears to be bound in the plumage which may act as a safety valve against mercury poisoning. The ban on mercury dumping has resulted in a significant decrease in mercury contamination from 1972 to 1978, but no concomitant increase in the reproductive success of Osprey.—Edward H. Burtt, Jr.

39. DDT and PCB residues in the Arctic Tern (*Sterna paradisaea*) nesting in the archipelago of southwestern Finland. R. Lemmetyinen and P. Rantamäki. 1980. Ann. Zool. Fenn. 17:141–146.—PCB and DDT compounds were most concentrated in newly hatched chicks and in females just prior to egg-laying. Nonetheless the concentrations of contaminants in Finnish populations of the Arctic Tern are far below concentrations found in gulls and terns nesting on the Great Lakes. Furthermore there is no evidence of developmental abnormalities or increased frequencies of egg and chick mortality among Finnish populations.—Edward H. Burtt, Jr.

40. The Brown Pelican: an endangered species? R. W. Schreiber. 1980. BioScience 30:742–747.—This species (*Pelecanus occidentalis*) is the only 1 of the 7 species of pelican that is truly marine and dives for its prey (fishes). Nesting is colonial and on islands free of mammalian predators. It breeds from North Carolina through the Gulf of Mexico and the Caribbean to Venezuela and from the Channel Islands of California to the Galápagos and central Chile. The adults live 25–30 yr so full production (3 egg clutch) need not occur every year. DDT or its metabolite DDE causes eggs to be thin-shelled from a few percent to as much as 50%. Thinning greater than 28% results in breakage during laying or incubation.

In general there was fluctuation in the breeding population in North and South Carolina, little reduction in Florida, extirpation in Louisiana, almost no survival in Texas, and great reduction in California. The virtual banning of DDT (1975) and decrease in the use of endrin have improved the environmental picture. Dieldrin and PCBs remain possible hazards. The improvement in eggshell thickness has been helpful. Oil spills may be an increasing danger. In some areas commercial fishing for anchovies and menhaden directly competes with the pelicans. The species must continue to be regarded as endangered. May we hope for an update of the situation in about 5 yr?—C. H. Blake.

41. Miscegenation in the Dusky Seaside Sparrow? F. C. James. 1980. BioScience 30:800–801.—The population of this subspecies (*Ammospiza maritima nigrescens*) appears now to consist of a few males in captivity. They have been bred with females of another subspecies. Females of this cross can be backcrossed to the Dusky males. By the third backcross the progeny will average 93.75% genetically Dusky. However, the program is not entitled to support under the Endangered Species Act, because the lawyers who wrote the Act defined a species as "any distinct population segment of any species," hence the program involves crossing 2 legal, not biological, species.—C. H. Blake.

42. The European Cormorant on Lake Baikal. [Bol'shoi baklan na Baikale.] O. Gusev. 1980. Okhota i Okhotnich'e Khoziaistvo 3:14–16 and 4:14–16. (In Russian)—One of the most numerous, obvious, and widely distributed birds of the Lake Baikal fauna has quietly disappeared. This is the European Cormorant (*Phalacrocorax carbo*). It was so plentiful that the earliest explorers of this region described "clouds" of cormorants and commented on the thick deposits of guano on their nesting colonies. It was so ubiquitous that from one end of the lake to the other, geographic features were named "Cormorant Island," "Cormorant Bay," and so forth. About 20 years ago, cormorants ceased to nest on Lake Baikal, and the last individual was recorded in 1971. Although in the second half of the last century, a decline in the number of cormorants was detected in the southwestern part of the lake, it still seemed that cormorants would be around forever, and it was more pressing to study other, more obviously disappearing species. Thus, very little was learned or can now be learned about the numbers, distribution, biology, or ecology of the European Cormorant here.

There appear to be several reasons for the species' gradual decline and complete disappearance from Lake Baikal. In the southwestern and most heavily settled part of the lake, the increased human population had a catastrophic effect on fish resources and so indirectly on other species (seals, cormorants) that relied on fish. Although a canned cormorant meat industry was once suggested, the birds were generally not considered edible, and up to World War II most of their nesting colonies were inaccessible. However, egg collecting increased during the war, and after the war motorboats became common and enabled people to visit colonies that used to be out of reach. Here they gathered eggs, killed the adults for diversion, and collected chicks as food for local fur farms. General disturbance was also a factor: when frightened off their nests, the cormorants did not soon return, and gulls took advantage of this to prey on cormorant eggs. "Oddly enough," the author concludes, "some very rare species of animals continue to exist in the Baikal area at the same time that one of the most numerous birds has rather suddenly vanished. But we must keep in mind that colonially nesting species are among the most vulnerable to human influence. There are many well-known examples and there is no need to list them; among the freshest and saddest is the European Cormorant on Baikal."—Elizabeth C. Anderson.

43. The Great Bustard in the Buryat Republic. [Drofa v Buryatii.] G. Kel'berg and M. Smirnov. 1980. Okhota i Okhotnich'e Khoziaistvo 5:12–13. (In Russian)—In the Buryat Republic, south and east of Lake Baikal, the formerly numerous Great Bustard *Otis tarda* has become rarer and rarer on the large open flat steppes and meadowlands. Now no more than 200 birds nest here, in three populations. Their decline is attributed to decrease in habitat, disappearance of indigenous vegetation they had been accustomed to eat, hunting, and disturbance as the area was settled—a process that intensified after World War II. Other animals of the steppes retreated to the mountain forest-steppe zone, but the bustard did not make this adaptation.

Males and then females arrive from winter in Mongolia only after snow has begun to disappear. They nest in brush or high grass, but when the young can leave the nest the family stays more in the open, sometimes forming a small flock with another family or two. They return southward in early fall, but some birds remain on Soviet territory south of Lake Baikal in mild winters.

As in Europe, if disturbance is minimal, the Great Bustard will nest close to fields and tolerate the close approach of vehicles. This suggests that it is fairly adaptable and could survive here, in one of the easternmost parts of its range, if given more protected habitat and aided by captive propagation.—Elizabeth C. Anderson.

44. Eggshell thickness in eleven sea and shore bird species of the Bothnian Bay. E. Pulliainen and A. Marjakangas. 1980. Ornis Fenn. 57:65–70.—Eggshell thickness in recent eggs (1977 and 1978) from Bothnian Bay was compared with earlier samples (1869–1952, mainly earlier than 1938). Only two species showed a significant difference. Arctic Tern (*Sterna paradisaea*) eggs were thicker (5.2%) in the recent sample, and Herring Gull (*Larus argentatus*) eggs were thinner (6.4%). Other studies in the Gulf of Bothnia have shown no apparent incidence of developmental defects in Arctic Terns as a result of chlorinated hydrocarbons over a period 1965–1973, although DDE residues were found in the birds. The decrease in shell thickness of Herring Gulls is not obviously related to pesticide pollution.

Eggshell thickness changes with incubation as calcium is absorbed by the embryo, and the authors found a decrease in thickness of 7.94% during incubation in the domestic hen and 8.19% in the Black-headed Gull (*Larus ridibundus*).—Robert B. Payne.

45. Effects of changing forest structure on long-term trends in bird populations in SW Finland. Y. Haila, O. Jarvinen, and R. A. Vaisanen. 1980. Ornis Scand. 11:12–22.—Attempting to duplicate methods used by an investigator 50 y ago, the authors recensused the breeding birds in an area of mixed forest and open land. Considerable change in the habitats had taken place during the half century, especially fragmentation of forest areas and maturation within the fragments. The authors tested the hypothesis that man-induced changes in forest structure cause changes in the forest bird community.

Different habitat types were described qualitatively. Edge habitats had 20% higher breeding bird densities than interior sites, but there were no clear differences in species diversity. Over the entire area, the percentage of non-passerines in the bird population had decreased 50%. This was attributed to the large home range requirements of some non-passerines being incompatible with small forest patches. Most passerine species showed density increases. No significant changes were detected in areas that had undergone little habitat alteration over the period. These general patterns are consistent with results of similar studies by von Haartman. No effort was made to examine population changes of neotropical migrants separately from those of other passerines. In the eastern United States neotropical migrants show a much more dramatic negative response to forest fragmentation than sedentary or less migratory passerines.—Marshall A. Howe.

46. Habitat characteristics and management of Swainson's Warbler in southern Illinois. W. R. Eddleman, K. E. Evans, and W. H. Elder. 1980. Wildl. Soc. Bull. 8:228–233.—This paper discusses the habitat characteristics of Swainson's Warbler (*Limnothlypis swainsonii*) so that habitat preservation for the species will be more effective. Warblers were found in a variety of vegetational types but bodies of water and giant cane (*Arundinaria gigantea*) understories were almost always present. Trees taller than 8 m and canopy coverage of more than 55% ($\bar{x}$ = 80%) also seemed necessary. Recommendations for creating the warbler's habitat are provided.—Richard M. Zammuto.

47. The Houbara Bustard in northwest Kyzylkum. [Drofa-krasotka (*Chlamydotis undulata macqueenii*) v severo-zapadnykh kyzylkumakh.] A. Alekseev. 1980. Zool. Zhurn. 59:1263–1266. (In Russian)—This large vegetarian species populates arid areas of Syrdar and Amudar and like many vegetarian species in arid areas has been in decline. The population has declined to one-third its former level. From 1956–1967 there was 1 nesting pair per 46 km of highway transect. During 1968–1979 the record was 1 per 125 km.—Leon Kelso.

PARASITES AND DISEASES

(see also 82)

48. Investigations on the European Cuckoo, *Cuculus canorus* (Biology, Ethology, and Morphology). [Untersuchungen am Kuckuck, *Cuculus canorus* (Biologie, Ethologie, und Morphologie).] H. Löhrl. 1979. J. F. Ornithol. 120:139–173. (In German)—Most of the data in the paper were from cuckoos held in captivity and from field observations on the fate of cuckoo eggs. Löhrl was unable to determine whether cuckoos formed pair bonds or were promiscuous. When a female cuckoo removes a host's egg, she swallows it. (One captive female ate 65 passerine eggs in one season.) The cuckoo lays her egg directly into the host's nest. The female cuckoo appears to be able to recognize the adults of the host species that reared her and, on finding a mated pair nest-building, will synchronize her reproductive cycle with theirs. There is a great deal of intraspecific variation by a host species whether it accepts, deserts, or builds over a cuckoo egg in its nest. In some cases the cuckoo egg resembles that of the host species, in others it doesn't. When the cuckoo egg bears little resemblance to the host's and is accepted by the host, Löhrl concluded that the species is a recent host, and there has been no selection for egg mimicry yet. The reaction of *Phylloscopus* warblers, on the other hand, is so strong, that they are probably former hosts, but cuckoos rarely parasitize them any more.—Robert C. Beason.

PHYSIOLOGY

(see also 5, 7, 8, 9, 14, 28, 48, 57)

49. Comparison of the "mammal machine" and the "reptile machine": energy production. P. L. Else and A. J. Hulbert. 1981. Am. J. Physiol. 240: R3-R9.—Papers that do not deal directly with birds are seldom reviewed in this journal. However, in the present case an exception is made as birds are simultaneously similar to reptiles and mammals and any finding about the energy production of homeotherms should be relevant to our understanding of the metabolism of birds. The authors compare the metabolic capacity, mitochondrial enzyme activity and mitochondrial volume and surface area of a lizard, *Amphibolurus nuchalis,* with that of the mouse, *Mus musculus.* Both species are similar in size, have similar body temperatures (or preferred temperatures) and were maintained under similar conditions, but the standard metabolism of the mouse is 7–8× that of the lizard. Enzyme activities and measurements of mitochondria indicated a 3–6× capacity for energy production in the mammal, but differences in energy production capacity were not due to any single variable. The paper has a casual style and several striking "typos" that might put off some readers, but the purpose and scope are well worth examining.—C. R. Blem.

50. Physiogenesis of endothermy and its relation to growth in the Great Horned Owl, *Bubo virginianus.* J. C. Turner, Jr. and L. McClanahan, Jr. 1981. Comp. Biochem. Physiol. 68A:167–173.—Great Horned Owls develop homeothermy relatively rapidly. Four-week-old owlets thermoregulate nearly as well as adults. Precocial development of homeothermy is enhanced by rapid development of insulation and relatively large body mass. Few studies of the ontogeny of thermogenesis in raptors exist and this paper makes a valuable contribution.—C. R. Blem.

51. Metabolic and behavioral responses of American Kestrels to food deprivation. C. J. Shapiro and W. W. Weathers. 1981. Comp. Biochem. Physiol. 68A:111–114.—Basal metabolic rate (BMR) and body temperature declined with duration of starvation to 79 h. Locomotor activity was highly variable and not correlated with weight loss or metabolism. The authors conclude that the decline in BMR is so great as to indicate active suppression of metabolism.—C. R. Blem.

52. Seasonal changes in the activity of the thyroid glands and its interaction with testicular function in the Pied Flycatcher *Ficedula hypoleuca.* B. Silverin. 1980. Gen. Comp. Endocrinol. 41:122–129.—Sampling of these hole-nesting, migratory birds during the 4–5 month period on their breeding grounds in Sweden indicated a relation between breeding status and the activity of the thyroid, as judged by histological analysis. The height of the thyroid cells reached maximal values during incubation and the nestling period. Several groups of birds captured after arrival on the breeding ground were injected with various concentrations of hormones to evaulate the relation between thyroid and testicular activity. Injection of thyroxine did not significantly affect testicular mass but did reduce the size of Leydig cells and stimulated premature molt. Suppression of thyroid activity did not prevent testicular regression. Injection of testosterone significantly depressed thyroid activity. These results suggest that thyroxine is necessary both for maximal development of the Leydig cells and for initiation of molt at the termination of breeding.—Cynthia Carey.

53. The significance of ground effect to the aerodynamic cost of flight and energetics of the Black Skimmer (*Rynchops nigra*). P. C. Withers and P. L. Timko. 1977. J. Exp. Biol. 70:13–26.—Flapping and skimming flight of Black Skimmers was analyzed kinematically and aerodynamically to determine the importance of ground effect. Although ground effect was never clearly defined or explained by the authors, they stated that an increase in lift and decrease in drag result when an airfoil is in close proximity to a surface. Skimming flight was characterized by gliding at a height of 8–10 cm above the water with occasional shallow wing beats. Mean velocity during skimming was 10 m/s, but varied considerably. Wing tips were held closer to the surface than the body, often touching, and the lower mandible was placed approximately 3 cm into the water. Hydrodynamic drag of the lower mandible was measured in a water channel and was found to be negligible due to excellent streamlining. Glide angle and sinking speeds during skimming were found to be lower than predicted as a result of ground effect. By gliding with the advantage of ground effect, skimmers can glide for considerable distances at a cost of less than 20% of flapping flight. From calculations Withers and Timko suggest that ground effect decreases the amount of time needed for foraging by decreasing the energetic cost of flight and that without this advantage skimmers would have to forage for at least 2 h more per day to maintain a positive energy budget. The authors maintain that ground effect is probably important during takeoff of birds with high wing loadings such as vultures and albatrosses as well as enabling species which normally cannot hover to hover near the ground. Any researcher involved in calculating foraging costs for flying animals should take note that ground effects as well as undiscovered energy saving mechanisms may profoundly influence calculations.—Paul Kerlinger.

54. Aerodynamics and hydrodynamics of the "hovering" flight of Wilson's Storm Petrel. P. C. Withers. 1979. J. Exp. Biol. 80:83–91.—The flight of Wilson's Storm Petrel (*Oceanites oceanicus*) during feeding bouts was studied using frame by frame film analysis and aerodynamic calculations based on morphological measurements. Two modes of flight were noted. In winds greater than 5 m/s wave soaring predominated, and below this wind speed a "hovering" mode of flight was used to generate lift. The "hovering" flight of this species differs from that of other hovering birds in that wing movement is severely restricted in the vertical and horizontal planes. A rapid pronation and supination of the wings is used instead, and Withers proposes that a wing flip mechanism is used for generation of greater lift coefficients than are possible for conventional aerodynamics. The wing flip is common in some insects, but is novel to bird flight and may be used by other hovering birds with low wing loading. The film used by Withers unfortunately did not have sufficient time resolution to confirm the wing flip mechanism. Withers explains that the function of the Petrel's curious behavior of dabbling or dragging its feet in the water while it hovers is to generate a hydrodynamic drag equal to its aerodynamic drag. Analogous to a kite on a string, the petrel can remain stationary over the water. Withers' study demonstrates the need for high-speed cinematography to study bird flight and the likelihood of discovering novel sources of lift used by birds.—Paul Kerlinger.

55. Ovarian development in an opportunistic breeder, the Zebra Finch *Poephila guttata castanotis*. R. Sossinka. 1980. J. Exp. Zool. 211:225–230.—Ovarian development of the Zebra Finch, a species that breeds at irregular intervals following unpredictable rainfall in the Australian deserts, differs considerably from that of photoperiodically stimulated species that breed with seasonal regularity. The ovaries of immature Zebra Finches develop to a medium developed resting state. Appropriate environmental conditions stimulate rapid logarithmic growth into full maturity. Egg laying can occur by 90 d of age. The maintenance of the ovaries in a medium developed state, coupled with the lack of a refractory period, allows these birds a rapid breeding response to irregular rainfall. The mechanism by which rainfall or other environmental conditions stimulate logarithmic growth has not yet been determined.—Cynthia Carey.

56. Breeding energetics in the Starling (*Sturnus vulgaris*). [Energetik des Brütens beim Star (*Sturnus vulgaris*).] H. Biebach. 1979. J. f. Ornithol. 120:121–138.—The energetic costs of incubation of the Starling were measured under different ambient and egg temperatures, using natural and hollow copper eggs. The temperature of the copper eggs was controlled by pumping water of the desired temperature through them. Between 12 and 20°C incubation heat is produced as a by-product of normal metabolism. Below 12°C, the metabolism of an incubating bird increased to 25–30% more than a non-incubating bird. At −10°C the metabolic rate of an incubating bird was 47–84% higher than at 20°C for the same bird. The starlings were capable of maintaining normal incubating temperatures for the eggs when ambient temperatures were below −10°C. The abandonment of clutches in severe weather is therefore caused by some factor other than the ability of the bird to keep the eggs warm.—Robert C. Beason.

MORPHOLOGY AND ANATOMY

(see 1, 53, 54, 78)

PLUMAGES AND MOLT

(see also 10, 38, 64, 78, 79)

57. Weights and primary growth of Brent Geese *Branta bernicla* moulting in the Queen Elizabeth Islands, N.W.T., Canada, 1973–1975. H. Boyd and L. S. Maltby. 1980. Ornis Scand. 11:135–141.—Incidentally to other work on Brants, weights and primary growth information were obtained on flightless molting birds. All birds were trapped between 14 and 27 July, in the middle of the 22–25 day flightless period. Of major concern was determining whether such an intensive period of molt caused obvious energetic stress. Although weights of molting birds averaged 5–7% lower than Brant weights averaged throughout the year, there was no clear evidence of stress, except (possibly) very slight atrophy of the pectoralis. Although samples were small, evidence suggested that males experience a small weight gain prior to molting. Individuals recaptured during the same month invariably showed weight loss during the period of primary replacement, which occurs at a rate of about 6 mm/d.

Conclusions about weight changes drawn by the authors are not clear and the reasoning appears circular: they first attribute their failure to find population-wide weight changes *during* the molt period to concentrating samples in the middle of the molt period rather than distributing them throughout (implying that they expected to find weight changes); yet, when they find weight losses in individual birds, they contrast this with the steady state in the population as a whole and conclude that these weight losses were a consequence of capture and handling.—Marshall A. Howe.

ZOOGEOGRAPHY AND DISTRIBUTION

(see also 4, 15, 17, 30, 80)

58. Quantitative biogeography of Finnish land birds as compared with regionality in other taxa. O. Järvinen and R. A. Väisänen. 1980. Ann. Zool. Fenn. 17:67–85.—There is abundant documentation of Buffon's Law, that different areas are inhabited by different species, but no unanimously agreed upon explanation, particularly for biogeographic transitions over relatively short distances. Quantitative distribution patterns of breeding land birds revealed 6 avifaunal zones in Finland: arctic, hemiarctic, north-boreal, mid-boreal, south-boreal, and hemiboreal zones. Zonal transitions were usually the result of differences in the area of major habitats. However, the boundary between the north-boreal and mid-boreal zones resulted from a shift in avian species composition without equally striking differences in habitat. Comparison of avifaunal zonation and zonation of other species suggests the biological significance of taxonomic differences. Two important generalizations emerge. First, north of the Arctic Circle some species (e.g., birds) show considerable regional heterogeneity, whereas other species (e.g., ants) do not. Such variation in heterogeneity of distributional patterns suggests differences in adaptability of different taxa to arctic/alpine conditions. Second, the avifauna of southern Finland is relatively homogeneous whereas other groups show more heterogeneity. The authors suggest that the exceptional mobility of birds leads to a more "fine-grained" use of the habitat than is possible among more sedentary organisms—thought-provoking ideas. The paper is clear and well reasoned. However, I am extremely impressed by the geographical scope of the census work that laid the firm data base on which this paper rests.—Edward H. Burtt, Jr.

59. Distribution and abundance of birds on the arctic coastal plain of northern Yukon and adjacent Northwest Territories, 1971–1976. R. E. Salter, M. A. Gollop, S. R. Johnson, W. R. Koski, and C. E. Tull. 1980. Can. Field-Nat. 94:219–238.—The arctic coastal plain of the northern Yukon east to the MacKenzie River delta is a potentially rich oil and gas field. It is also a surprisingly rich avifaunal region that has received too little study. Baseline data on avian diversity and abundance are provided in this report.

Biologists recorded 122 species between 1971 and 1976 of which 46 species were known to breed and 14 additional species may have bred. The data extend the known breeding ranges of Brant (*Branta bernicla*), Mallard (*Anas platyrhynchos*), Pintail (*A. acuta*), American Wigeon (*A. americana*), Northern Shoveler (*A. clypeata*), scaup (*Aythya* spp.), Pectoral Sandpiper (*Calidris melanotos*), Stilt Sandpiper (*Micropalama himantopus*), Buff-breasted Sandpiper (*Tryngites subruficollis*), Red Phalarope (*Phalaropus fulicarius*), Say's Phoebe (*Sayornis saya*), Yellow Wagtail (*Motacilla flava*), Yellow Warbler (*Dendroica petechia*), White-crowned Sparrow (*Zonotrichia leucophrys*), and Fox Sparrow (*Passerella iliaca*). Additionally the area is an important staging area for Snow Geese (*Chen caerulescens*) and an important molting site for Oldsquaws (*Clangula hyemalis*) and Surf Scoters (*Melanitta perspicillata*).

What changes will be wrought by the mineral exploitation of Canada's arctic slope? Predictions are difficult, but studies such as this offer an opportunity to observe changes from a known baseline.—Edward H. Burtt, Jr.

60. Results of a winter census of larids in Algeria. [Résultats d'un recensement hivernal de laridés en Algérie.] J.-P. Jacob. 1979. Le Gerfaut 69:425–436. (In French)—Eleven species were identified and counted during 2 weeks in Dec. Most noteworthy perhaps is the count of 824 Audouin's Gulls (*Larus audouinii*), high considering it is the rarest breeding gull of the Mediterranean region.—Robert B. Payne.

61. The mysterious movements of *Lamprotornis splendidus bailundensis*. A. Prigogine and C. W. Benson. 1979. Le Gerfaut 69:437–445.—Splendid Starlings live in the forest canopy in tropical Africa, eating mainly fruit. The form *bailundensis,* distinguished in males, at least, by the color of the crown (green), chest (blue band), back (blue gloss), and lesser wing coverts (bluish), is known from south-central Africa only in June to January, with breeding records in Sep. and Oct. for northern Zambia. Where do the birds go in the off-season?

Prigogine and Benson examined 800 specimens of the species in several museum collections and found 7 specimens that matched the description of *bailundensis* (except for the wing coverts) dated in the period Jan. to May. One lacked a locality more precise than "Congo," one was from Mabira, Tanzania, the other 5 were from Zaire, all north of the equator in Ubangi, Lower Uele, and Upper Uele. Apparently the form migrates seasonally 1000 km across the equator. Another bird of this forest zone (but extending much farther south), the insectivorous Pigmy Kingfisher (*Ceyx picta*), has a similar movement a couple months later.—Robert B. Payne.

62. Lodnaver–Kjalkaver (Central Iceland), a hitherto unrecognized important breeding area of the Pink-footed Goose, *Anser brachyrhynchus*. C. M. Lok and J. A. J. Vink. 1979. Le Gerfaut 69:447–459.—Previous field work showed that Thjórsárver in central Iceland was the main breeding population of western Pink-footed Geese, with several thousand pairs (though decreasing in recent years). The authors found a second major population in Iceland with a breeding ground for at least 800 pairs. Previous field work had shown a few birds breeding here. The colony may have become established within the past 10 years or so.—Robert B. Payne.

63. Wahlberg's Eagle *Aquila wahlbergi* in Rwanda. [L'Aigle de Wahlberg, *Aquila wahlbergi,* au Rwanda.] J. P. Vande Weghe. 1979. Le Gerfaut 69:461–474. (In French)—Wahlberg's Eagles were studied in Rwanda between 1969 and 1979. The highest density is in the Mubari hills in Akagera National Park (1 pair/35 km^2), but the eagles are widely distributed, and avoid only the wetter areas and higher elevations. They are uncommon in Rwanda between May and July. Most birds seen in passage may be birds that breed in the southern third of Africa. Wahlberg's Eagles nest in Rwanda mainly in November, about the same time of year that the species nests in Africa south of the Zambezi River.—Robert B. Payne.

64. The evolutionary biology of kingfishers (Alcedinidae). C. H. Fry. 1980. Living Bird 18:113–160.—This paper provides an evolutionary analysis of the 86 kingfisher species (3 subfamilies, 14 genera) throughout the world, emphasizing diet, habitat, nesting location, geographic origin, suspected lineage affinities, foraging behavior, bill shape, and plumage.

Kingfishers have a varied diet: fish, insects (most orders), mammals, birds, reptiles, amphibians, mollusks, earthworms, crustaceans, chilopods, diplopods, arachnids, and garbage. They feed in many habitat types: woodland, savanna, grassland, paddyfields, atolls, mangrove swamps, wooded swamps, rain forests, mountain torrents, and riparian uplands. Many have nest helpers, and nests are placed in several substrates: tree holes, earth banks, rotten stumps, and rabbit burrows. Foraging behavior includes diving, digging, sallying, flycatching, and hovering. Most kingfishers are territorial and have greenish and/or bluish plumage. All but one are diurnal.

Malaysia contains more kingfisher species than any other area. Forty-nine species, 57% of the world's kingfisher species, live there and most are endemic. The author claims these and other data support the contention that the family arose in Malaysia.

A supposed phylogeny of the 9 species of ceryline kingfishers (subfamily Cerylinae, 3 genera) is displayed in an excellent diagram (p. 146) which, in my opinion, should serve as a useful model for future zoogeographic/phylogenetic studies.

The range is mapped and subspecific information is provided for all 86 species. Adult weights are shown for 50 species.—Richard M. Zammuto.

65. Seabird records from Tonga—an account based on the literature and recent observations. J. A. F. Jenkins. 1980. Notornis 27:205–234.—Seabirds of the Tonga area are of particular interest because several rare and little-known species occur, and presumably breed, in the vicinity. Jenkins, a professional sailor, provides an excellent synthesis and analysis of the avifauna, and uses his own extensive field observations to clarify the status and distribution of the pelagic birds. Included are field notes on species that few ornithologists have seen or studied. Among notes of special interest to U.S. ornithologists is an observation of Mottled Petrels (*Pterodroma inexpectata*) migrating northward in a flock of Sooty Shearwaters (*Puffinus griseus*). Many islands near Tonga have never been studied by ornithologists. Jenkins names those of particular importance as breeding stations which should be set aside as sanctuaries, at least until adequate surveys have been made. In light of population pressures, however, such action is unlikely.—J. R. Jehl, Jr.

SYSTEMATICS AND PALEONTOLOGY

(see also 26, 64)

66. Intergradation of eastern American Common Eiders. H. L. Mendall. 1980. Can. Field-Nat. 94:286–292.—Extensive comparison of bill and facial plumage characters revealed extensive intergradation among the three subspecies of the Common Eider, *Somateria mollissima dresseri, S. m. borealis,* and *S. m. sedentaria.* The mixed pairing may occur during the northward molt migration of males from the St. Lawrence or on the wintering waters of coastal Maine or on the breeding grounds. Mendall favors the latter hypothesis as best explaining the distribution of intergraded characters.

As a nonsystematist I was bothered by this paper. In searching for distinct phenotypic limits to subspecies are we not searching for an illusion? Shouldn't we expect intergradation of subspecific characters? Shouldn't the focus be on phenotypic evidence for the distribution of genes and the rate of gene flow within the species' population? The data presented in this paper are interesting, the hypotheses regarding intergradation are intriguing, but I remain uncomfortable with the apparent emphasis on static, phenotypic distinctions among subspecies. How useful is the subspecies concept? Does the concept help or hinder evolutionary thought?—Edward H. Burtt, Jr.

67. The field identification and distribution of the prions (genus *Pachyptila*), with particular reference to the identification of storm-cast material. P. C. Harper. 1980. Notornis 27:235–286.—Prions (or whalebirds) are a problem. The genus consists of several very similar forms that differ in bill morphology and subtle details of coloration. Species limits are controversial. In this deceptively titled but important paper, Harper has provided a major review of the genus, treating all aspects of the biology of the forms (he recognizes 6 species), as well as providing an analysis of age, sex, and geographic variation. The paper is well illustrated and drawings of bill shapes of the taxa (which have been uncritically copied in so many papers) are corrected. Other important data include a discussion of differences in fresh vs. preserved material, both in size and coloration, and comments on what can be learned from studying wrecks of seabirds. The tendency for male prions of some species to wander widely will be of particular interest to population biologists. This paper is an essential reference to anyone interested in seabirds and will be especially valuable to perplexed curators.—J. R. Jehl, Jr.

EVOLUTION AND GENETICS

(see also 13, 16, 19, 26, 66, 81)

68. Experimental confirmation of heritable morphological variation in a natural population of Song Sparrows. J. N. M. Smith and A. A. Dhondt. 1980. Evolution 34:1155–1158.—In a logical extension of earlier work, the authors cross-fostered young to determine the relative importance of similar genes and similar environments in determining beak length, depth, and width, and tarsus length. Parent-young regressions were significant for true parents, nonsignificant for foster parents, indicating that the correlations noted in earlier work were the result of genetic similarities among parents and their progeny, i.e., resulted from a high heritability for those traits. As the authors note, the question becomes, how is the large amount of genetic variation observed to be explained?—William M. Shields.

69. Determination of the time of day at which diurnal moths painted to resemble butterflies are attacked by birds. M. R. Jeffords, G. P. Waldbauer, and J. G. Sternburg. 1980. Evolution 34:1205–1211.—Field studies of the effects of mimetic coloration use recapture rate differences as indicators of the protection afforded by mimicry. Here the authors demonstrate a time related bias in the probability of predation by diurnal avian insectivores. Only in the late afternoon was avian predation pressure sufficient to demonstrate the protective effects of mimicry. Only when experimental animals were released at a time that insured activity during the critical period, which surprisingly did not include early morning, were mimics recaptured at greater rates than controls. Earlier work that did not control for this potential bias and reported no mimicry effects were called into question.—William M. Shields.

70. Evolutionary genetics of birds. J. C. Avise, J. C. Patton, and C. F. Aquadro. 1980. J. Heredity 71:303–310.—The authors provide an electrophoretic analysis of 28 species of Wood Warblers (Parulidae) which adds to the impression that the pattern of genetic differentiation in birds is anomalous. The within-population variation (heterozygosity) observed in warblers is little different from other vertebrates. Among higher taxonomic levels, however, the pattern is significantly more conservative in birds. The mean genetic distance among species within warbler genera was $\overline{D} = 0.056$ and among genera $\overline{D} = 0.175$. This is considerably lower than the averages reported for the rest of the animal kingdom (e.g., the $\overline{D} = 0.40$ and $\overline{D} = 1.256$ reported here using the same techniques for Cricitine rodents). After assessing independent lines of evidence, the authors conclude that the most likely explanation is that the "protein clock" is slower in birds than in other taxa. Just why the rate of protein divergence between reproductively isolated and morphologically differentiated taxa of birds is retarded is, they maintain, a matter of conjecture. Their only strong conclusions are a caution, if protein clocks do vary with taxa, they may prove useless in determining absolute divergence times for poorly fossilized organisms, and a challenge, "These considerations underscore our general ignorance about the genetic processes responsible for organismal evolution."—William M. Shields.

FOOD AND FEEDING

(see also 32, 35, 51, 64, 82)

71. Nutmeg dispersal by birds. H. F. Howe and G. A. Vande Kerckhove. 1980. Science 210:925–927.—Six species of birds and a spider monkey ingest seeds of "nutmeg"

(*Virola surinamensis*), remove the red, highly nutritious aril, and regurgitate the unharmed seed. A 7th bird, *Tityra semifasciata,* is a "thief frugivore" which merely drops the seed and does not aid the dispersal of the tree. It is shown that the greater the weight of aril relative to seed weight, the more likely it is to be taken, hence smaller seeds are taken by preference. The tree is not the nutmeg of commerce (Dr. Howe *in litt.*).—C. H. Blake.

72. **On the role of Rooks in rural biomes of the steppe zone.** [O rolei grachei v agrobiotsenoze stepnoi zony.] Y. Anokhina and E. Golovanoca. 1980. Ekologiya 1980:86–98. (In Russian)—The food of Rooks (*Corvus frugilegus*) has been analyzed for various Soviet areas since 1953. Rooks are active members of rural biomes where they exert a real influence on numbers and habitat of invertebrates, particularly insects, e.g., darkling and ground beetles, Tenebrionidae, and Carabidae. A particular feature is their gleaning insects from dry cattle dung. In arid areas the Rook concentrates on unearthing coprophagous insects which use droppings as a cover. Among these are ant larvae. This turnover of cattle manure is prevalent in Rook foraging areas. Food carried to nests averaged 25 trips per day, about 3.5 kg per day per rookery.—Leon Kelso.

SONGS AND VOCALIZATIONS

(see also 75, 76, 82)

73. **Vocal behavior of the Marsh Warbler, *Acrocephalus palustris*.** F. Dowsett-Lemaire. 1979. Le Gerfaut 69:475–502.—Marsh Warblers are remarkable for their long, complex songs and their imitations of the songs of scores of other species, both European and African, that they hear in migration and in winter quarters. This paper, one of a series by the author on the songs and behavior of Marsh Warblers, describes the context of song and the structure in audiospectrogram form and the context of the other vocalizations. Full song is given for many minutes or even hours with no break; calls are simpler in structure and are shorter.

Full song is given by territorial males mainly before a female appears. Unmated males sing early in the morning and mated (brooding) males sing almost entirely around midday. Song decreases as soon as a female enters a territory and is accepted. After they are paired, males sing mainly when an intruder or a neighbor turns up at the territory. After the young have hatched, the males stop singing and feed their nestlings. Dowsett-Lemaire reasons that song has mainly a sexual function in the Marsh Warbler because it is given mainly before pair formation, and in this the behavior is similar to other European *Acrocephalus* species (e.g., Catchpole, Behaviour 74:149–166, 1980). However, song is given also in male-male contexts, with a bird on the defensive matching the song motifs of the locally dominant male. Males also sing in situations that seem to the author "quite peaceful" and she terms this behavior "social singing." On fine sunny days males sing near their common territory boundaries, each concealed in a bush in his own territory. Dowsett-Lemaire belives the behavior not to be aggressive or adaptively functional and she suggests that "it is probably just an expression of the birds' excitement."

One color-banded female sang an imitative song that was indistinguishable from a male's song, during the two days before she began a nest. She sang especially when she tried to evict a male newcomer from the territory. Her mate "took no part in territorial defense."

Marsh Warblers have an "alarm song" of 1–2 s; it lacks the ongoing character of "true song" but is just as likely to contain mimicry, and it sometimes is entirely imitative of other bird species. Both males and females were heard to give it. The form of song is stereotyped, each bird giving its particular version on all occasions even in successive breeding seasons. Marsh Warblers also have "non-imitative short songs" given mainly by females, who use it to keep in contact with the mate and to join him in chasing out an intruder as well as when she sings "as an expression of a certain degree of comfort or excitement." Other calls include alarm calls, aggressive calls, and juvenile location calls. Adult males and females have an equivalent vocabulary (12 classes of songs and calls) though the females give the "full song" only occasionally.

During the winter in Africa the same calls and songs are given, but the context for song at least is different as the singing birds are not territorial and do not respond to playback of their song. The author's explanation for song in this context is internal and not adaptive. As with social song it is suggested that song "can probably be best interpreted as an outflow of surplus energy."

Contexts and suggested messages are described for each of the songs and calls, but the documentation is anecdotal and there are no tables showing the specificity of each call with each context. It seems arbitrary to draw some of the lines between call types, and, as the author notes, different workers may be lumpers or splitters this way, so it is impossible even to compare properly the size of the call repertoire in different species. It would be helpful at least to illustrate audiospectrograms of the ranges of each kind of call and not only the "typical" form.

I regard the study as a very worthwhile description of the context of the different songs and calls of the Marsh Warbler. It is disappointing however to read the cop-out ethological "energy" or "excitement" interpretations of behavior; these statements are not worded here (nor generally) in a testable form, and they certainly don't replace our search for the adaptive significance of the behavior.—Robert B. Payne.

74. Neighbour-stranger song discrimination in the Chaffinch (*Fringilla coelebs*). J. C. Pickstock and J. R. Krebs. 1980. J. f. Ornithol. 121:105–108.—Contrary to most previous studies involving the playback of neighbors' and strangers' songs at the edge of a territory, the Chaffinch shows little discrimination between the two song types. The results are consistent, however, with the hypothesis that there is less discrimination in species, such as the Chaffinch, which have a large repertoire.—Robert C. Beason.

PHOTOGRAPHY AND RECORDINGS

75. Voices of the loon. W. E. Barklow and R. J. Lurtsema. 1980. National Audubon Society, NY. No price given.—How can one objectively review the calls of the Common Loon (*Gavia immer*); calls that epitomize wilderness; the cool breath of dawn on a lake that mirrors an unbroken crown of majestic spruce? I cannot, but let me make a few objective comments. The recordings are of consistently high quality with no annoying microphone noises. The sound is clean and balanced throughout the frequency range. The narration is interesting, informative, literate, and pleasant to the ear. The back of the jacket contains sound spectrographs that complement the narration and recorded calls extremely well. Technically and intellectually this is a fine piece of work, but having been objective (tried at least), I now close my eyes and listen to the wonderful calls. To anyone who has ever heard a loon, to anyone who dreams of hearing a loon, I recommend this record. Listening will gladden the wilderness spirit within you.—Edward H. Burtt, Jr.

76. Voices of New World Nightbirds, Owls, Nightjars, and their Allies. J. W. Hardy. 1980. Bioacoustic Archive, Florida State Museum, Gainesville, FL. No price given.—The recordings on this record are admirable not just for their quality, which is generally good and always acceptable, but because many of the species are exceptionally difficult to record and have never before been recorded. Hence this record is an important document. Its importance is marred by misidentifications and discrepancies between narration and jacket information on the original record jacket. These errors have been subsequently corrected, but unease about the identification of species lingers. Nonetheless, this is an important step in a little known field.—Edward H. Burtt, Jr.

MISCELLANEOUS

77. Antbutterflies: Butterflies that follow army ants to feed on antbird droppings. T. S. Ray and C. C. Andrews. 1980. Science 210:1147–1148.—Birds, chiefly Formicariidae, follow columns of army ants (*Eciton burchelli*) and feed on insects flushed by the ants. In Costa Rica, females of 3 species of butterflies (Nymphalidae, Ithomiinae) feed on the droppings of the antbirds. The authors conclude that this is a predictable source of protein which enables the insects to produce more eggs than would be possible if they had to rely only on the protein reserves acquired during larval life.—C. H. Blake.

BOOKS AND MONOGRAPHS

78. Avian adaptations to winter conditions of the subarctic. [Adaptatatsiya ptits k zimnim usloviyam subarktiki.] A. V. Andreev. 1980. Nauka Press, Moscow. 176 p. (In Russian)—This book is the outcome of the author's personal longterm explorations in continental northeast Siberia. Incidentally, this includes the most exhaustive bibliography that I have examined. References are complete even to pagination, volume, and serial numbers. Besides the Russian, there are about 140 other citations, mostly English. About 22 selected wintering species (equivalent to those in Alaska) are detailed as to general ecology and bioenergetics, particularly as adapted to extremely frigid conditions. This may mean subzero survival at −40, even −60°C on the roost. The author devised experimental modes of determining energy parameters of birds in the wild. Determined were features of external and internal morphology as well as behavior of sedentary birds. It is well noted here that endurance of severe cold involves plumage and how that is managed in subzero conditions is illustrated by selected examples. In conditions of subarctic winter the survival of birds depends primarily on the time spent searching and foraging for food. Sedentary species are able to elaborate effective adaptations to control energy loss. Therefore day length is not the controlling factor for most wintering species that it appears at first glance.—Leon Kelso.

79. The Hazel Hen. [Das Haselhuhn.] H.-H. Bergmann, S. Klaus, F. Muller, and J. Wiesner. 1978. Die Neue Brehm-Bucherei. A. Ziemsen Verlag, Wittenberg, Lutherstadt. 196 p. (In German)—Whether this monograph does justice to the Hazel Hen rests on the judgment of those knowing it in the wild. The authors are an unusual collaboration of East German and Soviet authors. This volume is dedicated to the eminent ornithologist, mammalogist, and conservationist O. Semenov-Tyan-Shanskii. Naturalists may persist according to their own code, free of the fortunes of love or war. Or, as President Truman said: "These artists must have their fun."

Of interest here is the concentration on plumages. Patterns are depicted pictorially as are behavior, roosting, bathing (sun, dust, and snow), snow denning, anting, and comfort responses. There is an abundance of detail and discussion on foraging and food, and conservation, as well as comparison with behavior of other Phasianidae.—Leon Kelso.

80. Status and Distribution of Birds in Southern Quebec. N. David. 1980. Club des Ornithologues du Quebec, Charlesbourg. 213 p. No price given.—Since 1955 members of the Club des Ornithologues du Quebec (COQ) have contributed nearly 40,000 field checklists to a central data bank. *Status and Distribution of Birds in Southern Quebec* is an analysis of these data through February 1977 and of all published records and reports of birds in Quebec south of 52°N through 31 December 1978. The work is organized as an annotated species list which presents seasonal abundance information and summarizes available documentation of species occurrence in southern Quebec. It is also apparently an English translation of a French volume of the same name (that I've not seen) published by the COQ. The result is a jewel in the rough. The information presented is well-organized and documented; David very clearly enunciates novel concepts in treatment of distribution data and lucidly restates traditional ones. Two sorts of data, frequency and abundance, are involved in estimation of status and distribution. The COQ data set, as David acknowledges, is subject to unknown and possibly very large errors in abundance estimation. Minimal assumptions are required for use of the data to determine frequency and duration of occurrence, however. David uses proportion of field lists in a 5-day period that mention a species as his raw data. Status classes are then unambiguously defined as frequency categories. For each species frequency histograms are presented that show abundance changes during the year in each of three subregions of southern Quebec. Such a presentation is not new, but its beauty in this case lies in its repeatability. The usually subjective abundance categories are here empirically defined. David's treatment of the ancillary categories of the birdlist is most refreshing as well. Anyone who has written or may write a faunal work will benefit from his cogent remarks on the "Hypothetical" category. The intellectual effort in this work was well-planned and thoroughly executed. The book also includes indices to species and a locality gazetteer. My only wish for additional information was the hope for the French Canadian species names. Unfortunately, the typography, proof-reading, and other technical matters involved in the printing of the book were poorly done. Typographical errors are numerous; the potentially informative maps are very poorly executed, especially one that depicts the distribution of checklists but shows only the number of lists by grid unit without any reference outline drawing. The species frequency histograms could just as easily have been presented at a smaller scale as lines of varying width, darkness, or pattern, a move that would have shortened the work dramatically. In sum, this is an excellent work, well worth owning. The reader must be prepared, however, to ignore the poor printing to get to the good biology.—Paul B. Hamel.

81. Optical Signals: Animal Communication and Light. J. P. Hailman. 1977. Indiana University Press, Bloomington. 362 p. $15.00—Optical signaling is a major vehicle for social communication in animals and therefore is central to the understanding of animal behavior. Hailman attempts to articulate the characteristics of optical signals and the factors that dictate their design by using physical science to explore the nature of optical signaling. He uses his own behavioral observations and some from the literature to test his predictions. This approach represents a unique integration of scientific expertise that is desirable and important for the analysis of behavior.

Hailman's goal is to analyze optical signals used in social communication and to predict their characteristics. First he outlines his method of analysis, namely the cycle of scientific epistemology, which is the process of generating and testing models based on rigorous mathematical principles. Four classes of models describe the causes and origins of behavior at the individual (Control and Ontogeny) and population (Preservation and Phylogeny) level. Hailman uses these behavioral determinants throughout as a theme for outlining the factors involved in the communication process.

Communication occurs when a sender initiates a physical disturbance (signal) in a channel that is detected by a receiver. Hailman discusses signals and information (Chapter 2) relative to the fields of semiotics, cybernetics (information theory), and ethology (control theory). Some aspects of these fields, such as uncertainty and entropy in communication, and behavioral vectors and matrices, were informative independently, but contributed little to the book's content, and might have been better left to another treatise.

The types of communication are classified by the channel through which the signal passes, and by the communicants: the sender who generates the signal and the receiver who detects it. Chapter 3 addresses the optical channel and the physical properties of light, such as absorption, emission, reflection, transmission, and refraction. The characteristics of light as it is altered in the atmosphere are considered relative to the ambient light that falls on animals in terrestrial and aquatic habitats. This chapter is replete with technical information vital for comprehending subsequent chapters, but is sometimes difficult to follow. The necessary brevity in explaining these physical concepts may have obscured their meaning to many biologists.

The sender (Chap. 4) transmits information by creating variation in the temporal and spatial patterning of light. Animals use bioluminescence and vary biochromes, schemochromes, and physical movement to produce signals. Intrinsic signals (the source of patterning is the sender itself) comprise the bulk of optical signals although extrinsic signals (produced by some object fashioned by the sender) also are used. The behavioral and morphological elements of these signals are outlined and their possible phylogenetic origins discussed. Signal-like behavior or pseudosignals (behavioral stereotypy and physical characteristics evolved for reasons other than communication) are identified.

Hailman discusses the receiver (Chap. 5) relative to the constraints placed on communication by its abilities to detect optical signals. The animal's photoreceptivity and physiological capabilities for visual perception and discrimination set limits on optical communication.

Some animals use optical signals to deceive an observer (Chap. 6). They may suppress shadow and outline contrast or imitate some part of their environment. Animals remove consistency in what a receiver perceives by masking their symmetry, startle-deception, replicate-deception (producing copies of themselves in their environment), deceptive polymorphism, motion-deception, and/or combinations of these strategies. For intraspecific communication, animals may reverse the signal characteristics of deception to become conspicuous. This is maximized by physical movement and by enhancing shape and contrast. The characteristics of ambient light specific to habitat and background determine which aspects of conspicuousness are maximized. Transmission noise is any alteration of the signal that causes equivocation in the receiver. Signals must be designed to maximize spectral reflectivity in translucent media (such as fog, mist, or turbid water) or optimize the spatial arrangement of sender and receiver in opaque media (such as vegetated habitats). The conflict between concealment (e.g., from predators) vs. conspicuousness (e.g., to mates) may be resolved by efficient timing, changing the background, and general orientation of the sender with respect to the receiver.

The relationship between the referent, the optical signal and the information it carries is discussed in Chapter 8. Hailman analyzes optical signals by using semantics and the indexic, iconic and symbolic information they carry, syntactics and the relations of signals to each other, and pragmatics as the evolutionary consequences of the signaling process. He classifies the types of animal behavior (agonistic, reproductive, and cooperative) and attempts to define the signal-characteristics of each type.

Optical Signals concludes with a return to the 4 classes of behavioral determinants and a review of the problems in analyzing optical signals that emerged from Hailman's literature search.

Students of animal behavior who wish to ascribe "cause" to observed social behavior of animals are urged to read this book. A good methodical analysis of animal behavior should involve rigorous consideration of the biotic and abiotic components of that animal's experience. Hailman provides us with a useful guide and reference for analyzing the characteristics of optical signals.—Lise A. Hanners.

82. Greenshanks. D. Nethersole-Thompson and M. Nethersole-Thompson. 1979. Buteo Books, Vermillon, South Dakota. 275p. $27.50.—Desmond and Maimie Nethersole-Thompson achieve a rare blend of poetry and natural history. Their opening chapters evoke the harsh splendor of the Scottish moors, the exquisite beauty of the Greenshanks (*Tringa nebularia*), the joy, excitement, and frustration inherent in field work. These chapters dwell on the emotional satisfaction that is the field biologist's greatest reward, a point rarely evident in the scientific literature and still less often conveyed by undergraduate texts. With chapter 5 the emphasis shifts into a more scientific vein, but throughout the book the Nethersole-Thompsons convey an intense joy in the Greenshanks and all that is associated with them.

Chapter 5 emphasizes individual variability by relating anecdotes from Desmond's 45 y of watching Greenshanks. Variability is an important biological principal, but the emphasis it receives throughout *Greenshanks* may be excessive. Generalizations about the species' behavior, ecology, and population dynamics are possible and many generalizations are drawn, but become lost in the ensuing discussion of exceptions and anecdotes. More balance between generalization and anecdote is needed.

Population dynamics are described in chapter 6 for the Sutherland and Spey Valley populations studied by the Nethersole-Thompsons and are described for the species generally in chapter 17. The potential role of territory in population dynamics, discussed in chapters 6 and 8, is unclear. In some years there are floaters despite the fact that apparently suitable habitat is unoccupied. In other years floaters are absent and territorial males are unable to attract mates despite persistent display. The discussion of these matters is excellent and well supported with quantitative detail and anecdotes.

The analysis of vocalizations (chap. 7) is simply outstanding. Vocalizations are named onomatopoetically and grouped functionally. The description of each vocalization is accompanied by a sonogram that greatly enhances the verbal description. However there are some annoying problems, anthropomorphism beyond the bounds of poetic license, lack of quantitative detail on the use of the calls, and occasional loose reasoning such as when the authors suggest that the hen individually recognizes the cock merely because she looks up when he calls while flying overhead. She may, but she may look up in response to any sound overhead. Nonetheless the chapter contains much new material, is detailed, and most points are well documented.

Greenshanks use courting territories, where former mates may reunite, nesting territories, feeding territories on which the adults forage, and chick territories to which the chicks are led 24 h or less after hatching. Chapter 8 on territory is primarily descriptive and a fine source of data on territorial uses.

The description of courtship in chapter 9 lacks quantitative detail and fails to separate action patterns. It is not among the informative chapters.

Nest site selection, construction and structure of the nest are discussed in detail. Sites are remarkably consistent with a hen often choosing precisely the same nest site in successive years. Even different hens on the same territory in different years often chose the exact same nest site!

The cock guards the hen while she lays the first egg but is less solicitous with each succeeding egg of the 3–4 egg clutch. The eggs of each hen have a characteristic and consistent color and pattern, although there is a tendency toward duller eggs with increasing age. The incubation pattern develops gradually during egg laying with the cock usually taking the night shift and the hen the day. Exchanges at the nest occur in the early morning and again in the early evening. From initial cracking of the shell to emergence of the chick there may be as much as 172 h. I confess to skepticism, as that time period constitutes about 30% of the incubation period. Prior to hatching, the chicks interact vocally with each other and the parents, an observation that offers exciting possibilities for ontogenetic study. Excellent comparative data on eggshell removal are presented. As expected (Tinbergen et al., Behaviour 19:74–117, 1962; Burtt, Wilson Bull. 84:492, 1972), Greenshanks remove or eat the shells almost immediately after hatching. Parents guard the chicks for at least 25–31 d, the cock usually remaining with the chicks longer than the hen.

Diet and foraging behavior are discussed in chapter 14 where there is an excellent dietary analysis based on regurgitated pellets. However, the chapter is qualitative in its approach, although it raises many possibilities for quantitative ecological study. Predation on Greenshanks is discussed in the following chapter which includes discussion of nest destruction by red deer and sheep.

Chapter 16, by D. A. Ratcliffe, is an analysis of the Scottish breeding habitat of the Greenshank, both its present breeding habitat and probable changes in habitat occupancy since the last glaciation.

The last chapter is a summary of the book and a plea for comparative work on the Greater Yellowlegs (*Tringa melanoleuca*). The appendices that follow are filled with detailed information. I found the discussion of ecto- and endoparasites the most exciting as the information is all too rarely found in ornithological works.

The book is attractively illustrated with black-and-white drawings and color plates by Donald Watson in addition to some very fine photographs by a variety of photographers. The data tables are amassed at the end of the book, an editorial decision that I found extremely annoying as one had to refer back and forth during reading. Inexplicably some tables were labelled figures and included in the text. Despite these minor problems Desmond and Maimie Nethersole-Thompson have produced a monumental study, elegantly written, that will be a source of inspiration and ideas for future field biologists. *Greenshanks* belongs on the same shelf with Lack's *The Life of the Robin,* within every ornithologist's easy reach.—Edward H. Burtt, Jr.

83. Migrations of Birds of Eastern Europe and Northern Asia, Gaviiformes-Ciconiiformes. V. A. Ostapenko (ed.). Nauka Press, Moscow. (In Russian)—The book opens with an overview of bird-banding in Poland, the German Democratic Republic, Czechoslovakia, Hungary, and the Balkan Peninsula. The remainder of the book deals with the migratory patterns, deduced from banding records, of Gaviiformes, Podicipediformes, Procellariiformes, Pelecaniformes, and Ciconiiformes. The contributions of the many authors are organized by species within each order and by geographic region (e.g., Far East, USSR, Balkans) for species with multiple contributions. Although a fundamentally regional work, there is much general information on migration patterns and the literature citations reflect a high level of individual scholarship.—Edward H. Burtt, Jr.