RECENT LITERATURE

Edited by Bertram G. Murray, Jr.

BANDING AND LONGEVITY

1. Record longevity for vireo. S. Peaslee and B. Sorrie. 1976. Point Reyes Bird Observ. Newsl., **39:** 7.—A Warbling Vireo (*Vireo gilvus*) banded as an adult in June 1966 was recaptured 8 May 1976. Elapsed time between banding and recapture was about 9 years 11 months. This is apparently the greatest longevity yet recorded for any *Vireo*.—Roger B. Clapp.

MIGRATION, ORIENTATION, AND HOMING

2. Orientation of homing pigeons altered by a change in the direction of an applied magnetic field. C. Walcott and R. P. Green. 1974. *Science*, **184:** 180-182.—The results of this important study suggest that magnetic information plays a role in pigeon navigation. A small Helmholtz coil was placed above the pigeon's head as well as around its neck. A battery on the bird's back made it possible to induce a magnetic field of 0.6 gauss through the bird's head. Under sunny sky conditions the pigeon's ability to orient homeward was unaffected by the direction (polarity) of the induced field. Under overcast skies, however, the effect was dramatic. Pigeons released with the south magnetic pole of the induced field up (Sup condition) oriented toward home, whereas birds with the polarity reversed (Nup condition) often flew away from home. Despite the differences in vanishing bearings between the two groups, the homing performance was similar. The authors point out that this might be expected given the relatively short life of the battery compared with the return time of the birds.

These results are particularly interesting in light of a model of compass orientation based on magnetic information developed by the Wiltschkos. The model predicts that birds use the inclination of the magnetic field and interpret as north the direction in which the magnetic field vector and gravity vector form the smallest angle. Reversing the polarity of the induced field around a pigeon's head would reverse the magnetic field vector, which, in turn, would reverse the direction interpreted as north. It is also noteworthy that results from experiments with homing pigeons lend support to a magnetism model derived from work with migratory passerines.—Frank R. Moore.

3. The mystery of pigeon homing. W. T. Keeton. 1974. *Sci. Amer.*, **231:** 96-107.—Keeton's review is an excellent introduction to and review of our knowledge of pigeon homing (for more detailed coverage see his contribution in *Advances in the Study of Behavior*, **7:** 47-132, 1974). Keeton traces the development of our understanding of pigeon homing beginning with the seminal work of Gustav Kramer and continuing with emphasis on Matthew's sun-arc hypothesis of navigation and its subsequent demise, the resurrection of magnetism as a source of orientation information, the exciting experiments of Schmidt-Koenig and and Schlichte in which frosted contact lenses were used in homing experiments (see *Bird-Banding*, **45:** 61, 1974, review no. 4), the phenomenon of "release-site bias" and its possible relevance to the map component of navigation (see *Bird-Banding*, **45:** 272, 1974, review no. 1), the important work on sensory capabilities of pigeons taking place in the author's laboratory, as well as other significant contributions. The review clearly shows that a simple one-dimensional explanation of pigeon homing is no longer viable as our information now suggests that pigeons possess a redundant or hierarchial compass system for determining direction. Our understanding of the mystery of pigeon homing and, in turn, animal navigation is progressing, but so also is our appreciation for its complexity. —Frank R. Moore.

4. Angle sense in the Chinese painted quail (Excalfactoria chinese). F. W. Merkel and K. Fischer-Klein. 1973. *Die Vogelwarte*, **27:** 39-50. (German with English summary).—A series of experiments revealed that Chinese Painted Quail possess an "angle sense," i.e., the ability to detect deviations in their course, and that with a memory of locomotion they can compensate for such angular

changes. The test apparatus consisted of a corridor system (1 - 1.5 m long) which exited into a circular arena. When forced to pass through a corridor with an abrupt deviation (15° - 30°), the quail turned back toward the initial direction once in the arena. Furthermore, the birds responded appropriately to countercurrent turns, i.e., birds experiencing a turn of 60° followed by a reverse turn of 30° compensated fully for the initial deviation by turning approximately 30° upon entering the arena.

The "angle sense" of this species was demonstrated to be valuable in short-distance orientation. More significantly the ability to compensate for angular deviations has obvious implications for avian migratory orientation. Migrants are exposed to a variety of circumstances when the ability to "sense" deviations in their direction of movement would be selectively advantageous, e.g., displacements as a result of wind or when forced to alter course because of some topographical feature. An "angle sense" of this nature might well be an integral part of any re-orientation mechanism and certainly warrants further experimental attention.—Frank R. Moore.

5. Relationships between behaviour, physiology and weather in avian transients at a migration stopover site. J. H. Rappole and D. W. Warner. 1976. *Oecologia,* **26:** 193-212.—Transient migrants were mist-netted at a stopover site in southern Texas, weighed, banded, and in some cases color-banded. Concurrent observations of the behavior of these birds in the field were made. Particular attention was given to the Northern Waterthrush (*Seiurus noveboracensis*).

Rappole and Warner show from their results that some species were absolute transients in *Zugstimmung,* i.e., the physiological state conducive to ongoing migratory flight. Such birds were gregarious at the study site (even though the species was normally non-gregarious), stayed in the area only for a short period, and had broad habitat needs because of their independence of the food resources of the area while in *Zugstimmung.* In complete contrast were other birds in *Zugdisposition,* i.e., a state conducive to replenishing migratory reserves. Such birds were hyperphagic and aggressively territorial in defense of food resources at the same site for several days. Their food intakes rose by up to 40 percent during this period. Not all birds were immediately able to acquire territories, birds taking an average of 2.4 days to do so. Birds winning territories increased in weight, those failing to do so lost weight. Some individuals were forced into continued migration. Finally, Rappole and Warner showed that the choice between these various strategies was modulated by the weather conditions in the area.

This is a paper of major importance for the study of the interactions between migration, physiology, and behavior. I hope it receives the attention it deserves despite its rather unusual publication outlet.—Raymond J. O'Connor.

6. The detection and identification of birds in flight, using coherent and noncoherent radars. W. L. Flock and J. L. Green. 1974. *Proc. Inst. Electrical & Electronics Engr.,* **62**(6): 745-753.—Most conventional surveillance radars can detect birds readily, but they are very much limited in their ability to provide information that can be used to identify the birds. This paper suggests that the recording of amplitude and Doppler signatures can aid the identification of bird targets as to size and type. After a brief history of radar detection of birds, the authors discuss amplitude signatures and give examples for several species. The fundamental wingbeat frequency is the most readily determined characteristic of an amplitude signature, and the authors have emphasized this aspect. By performing spectral analyses the characteristic wingbeat frequencies of more than one species can be determined when two or more species are being detected simultaneously. The authors next examine the Doppler frequencies of echoes from birds utilizing a coherent radar. The Doppler signature of a bird contains information about the radial velocity of the bird relative to the radar and a spectrum of the velocities of the moving parts of the bird relative to its center of mass and is readily displayed by sonographic analysis. The corresponding amplitude signature is inherent in the Doppler signature. Because Doppler frequencies corresponding to bird velocities are well within the audible frequency range, they can also be analyzed by the human ear, if the radar output is amplified and connected to a loudspeaker. With practice one can tell the difference between large and small birds and even "hear" swooping, diving, and gliding.

The authors hope that these techniques will be used to help monitor hazardous concentrations of birds in an effort to reduce bird-aircraft collisions.—Sidney A. Gauthreaux, Jr.

7. Bird migration forecasts for military air operations. H. Blokpoel. 1973. *Can. Wildl. Serv. Occ. Pap.* No. 16, 18p.—Four factors of local weather were used for the migration forecasts at Cold Lake in east-central Alberta: surface wind, wind at 900 m, wind at 1,155 m, and precipitation. Previous studies by Richardson (1970) and Richardson and Gunn (1971) had shown surface wind to be the most important correlate of migration density in the area, the density being higher with a tail wind. Blokpoel during preliminary studies found that winds between W and N at altitudes of 900 m and 1,515 m above ground also tended to be associated with heavy SE movements and considered rain an unfavorable factor. Several guidelines were used in generating the forecasts. If all weather factors were neutral, migration would be of average intensity. If one wind factor was unfavorable but another favorable, they would neutralize each other. If all or most weather factors were unfavorable for three consecutive nights, their inhibiting effect would decrease and the birds would start to fly under unfavorable conditions in numbers greater than usual, and if late in the season (end of May and beginning of June in spring and October in fall), all or most weather factors were favorable for two or three nights, the numbers of migrating birds would decrease even though favorable conditions were present. Forecasts were considered accurate if the actual migration density was not more than plus or minus one scale unit from the forecast density (scale of 0 to 8). Radar films were used to verify the forecasts made about 1530 hours. After correcting for weather forecast errors, the bird migration forecasts for spring were 96 percent accurate and for fall 81 percent accurate.—Sidney A. Gauthreaux, Jr.

NESTING AND REPRODUCTION

8. The White-capped Albatross of Albatross Island: numbers and breeding behaviour. G. W. Johnstone, D. Milledge, and D. F. Dorward. 1975. *Emu*, **75:** 1-11.—The little studied White-capped Albatross (*Diomedea cauta*) remains little studied. The present article presents data on population size, reproduction, and excellent descriptions of many behavioral patterns, but the data were collected during a visit of only 10 days.

Although abundantly aware of the inadequacies of the study, the authors can point to several important findings. The population of White-capped Albatrosses doubled between 1960 and 1973 reaching a level five times that thought to exist in 1909. Nestling mortality appears to be low, although many chicks in peripheral areas of the colony were heavily infested with ticks (*Ixodes auritulus* Neuman), had matted dirty plumage, and responded weakly to approaching adults. The authors suggest that nibbling of the chick by the adult, behavior that precedes regurgitation and feeding, may remove ticks and debris from the chick rather than being merely a ritualized form of greeting.

The descriptions of behavioral patterns are generally excellent although often lacking quantitative detail. Despite the excellence of the descriptions and the variety of patterns described, the authors have occasionally used functional names (e.g., submissive posture) when strictly descriptive names would be more in keeping with the lack of data concerning function. The descriptions of behavior suggest that the White-capped Albatross is most closely allied with the other four mollymawks (*D. melanophrys, D. chrysostoma, D. bulleri,* and *D. chlororhynchos*) and less closely allied with the four North Pacific albatrosses (*D. albatrus, D. immutabilis, D. nigripes, D. irrorata*) and the two great albatrosses (*D. exulans, D. epomophora*). The behavioral data are corroborated by morphological comparisons. Although limited in its coverage of the reproductive biology of the White-capped Albatross, the paper is a provocative pilot study, and because the species' population is increasing, further study is a real possibility.—Edward H. Burtt, Jr.

9. Wedge-tailed Shearwaters on Muttonbird Island, Coffs Harbour NSW. P. E. Roberts, F. D. Merritt, and R. B. Floyd. 1975. *Emu*, **75:** 19-22.—The paper contains a detailed account of the reproductive biology of the Wedge-

tailed Shearwater (*Puffinus pacificus*). Unlike the Slender-billed Shearwaters (*P. tenuirostris*) that come to the colony en masse, pair, copulate in the burrows, and then vacate the colony en masse, the Wedge-tailed Shearwaters come to the colony en masse, pair, and copulate in the burrows for about three weeks prior to egg-laying. Individual pairs vacate the colony for at most two weeks, more likely one week, and the colony is never entirely devoid of adults between their arrival and egg-laying. Individual birds appear to return to the same location in which they nested in previous years, and former mates may reunite in subsequent years. These are common phenomena among procellariiforms (e.g., Huntington and Burtt, *Proc. XV Intern. Ornithol. Congr.*: 653, 1972) and seabirds generally (e.g., Coulson, *ibid.*: 424-433, 1972).—Edward H. Burtt, Jr.

10. Breeding biology of the Parakeet Auklet (Cyclorrhynchus psittacula) on St. Lawrence Island, Alaska. S. Sealy and J. Bedard. 1973. *Astarte*, **6**(2): 59-68.—One of 5 species of planktonivorous auklets of northern Pacific, the Parakeet Auklet is associated with Crested Auklets (*Aethia cristatella*) and Least Auklets (*A. pusilla*). This paper reports ecological segregation and comparative breeding ecology. The nests in rock interstices contain no nesting material. Snow may delay laying of the single egg until late June. Incubation is 35-36 days. Adult body and brood patch temperatures are 40.4 and 36.9° C, respectively. Hatched in late July, chicks grew in 25 days to a maximum of 350 g, then decreased to 77% adult weight when fledged, at the age of 35 days. Average daily chick food supply was 132 g. The percentage of eggs hatched was 67%, of growing young fledged, 76%. General breeding success was rated 52%.—Leon Kelso.

BEHAVIOR

(See also 4, 5, 8, 9, 40, 42)

11. The synchronizing effects of slight oscillations of light intensity on activity period of birds. F. Krull. 1976. *Oecologia*, **25:** 301-308.—In the high arctic summer light intensity oscillates slightly in the course of each 24 hours and could therefore possibly account for the 24-hour rhythmicity of bird activity in these regions. Krull kept small numbers of Chaffinches (*Fringilla coelebs*), Greenfinches (*Chloris chloris*), House Sparrows (*Passer domesticus*), and Canaries (*Serinus canaria*) on continuous light regimes of modulated intensities and examined the birds' activity patterns under these conditions for evidence of periodicity. Light intensity was modulated in different experiments in both sine wave and square wave patterns to give maximum to minimum light intensity ratios of 2:0 and 1:5, and the experiments were replicated for different mean illuminances. The results showed synchronized activity between birds was maintained by the maximum-minimum ratio of 2:0 but not by that of 1:5. Absolute light levels had little effect, except that high levels favored continuous activity. Little difference existed between sine wave and square wave results. Krull suggests that intensity oscillations at arctic light levels in summer are not adequate to entrain activity and favors instead the idea that daily oscillations in the spectral composition (color temperature) of the light provide the cues for 24-hour rhythmicity in the activity of the birds.

This report, well-executed though it is, leaves me with two queries. How valid is it to extrapolate the behavior of arctic species from (I presume German caught) birds more typical of temperate conditions? And how valid is Krull's conclusion that his birds were not responding to the sinusoidal nature of the 2:0 ratio light regime? He bases this conclusion on the similarity of response by the birds to sine and square wave modulation, yet the latter surely has a substantial sine component on Fourier decompostion.—Raymond J. O'Connor.

12. Ethological and ecological analysis of animal behavior during an eclipse of the Sun. R. Wojtusiak and Z. Majlert. 1976. *Folia Biol.* (Krakow), **24**(2): 191-211. (In English with Polish and Russian summaries.)—A summary of records from seven eclipses in Poland between 1954 and 1975. Many data indicated less responsiveness by domestic and caged animals than those in the wild. Disturbances of solar emitted ultra-short electromagnetic waves and earth magnetism as possible causes of eclipse related behavior are discussed following the many details recorded. "An eclipse cuts off or restricts the influx of solar radiation

to the earth over the whole range of electromagnetic waves; this may be regarded as the main factor." "In addition, an eclipse shifts the phases of all the animal biological rhythms, deranging, so to speak, their biological clocks."—Leon Kelso.

13. Threat display of the Australian Painted Snipe. K. A. Muller. 1975. *Emu,* **75:** 28-30.—Both the visual and auditory components of the Painted Snipe's (*Rostratula benghalensis*) threat display are dramatic as the pictures, line illustrations, and quoted descriptions of the behavior amply illustrate. Unfortunately the author adds nothing to what is already known. The display might more appropriately be named the "tail-wing fan" or any other descriptive name because the display's function is uncertain. The author's unqualified assertion that the pattern is innate is based on the display's occurrence in two two-week-old chicks, hardly a convincing data base.—Edward H. Burtt, Jr.

14. Individual recognition problems in gulls. (Nekotorye voprosy individualnogo opoznovaniya u chaikovykh ptits, Laridae.) V. Zubakin. 1976. *Byull. Mosk. Obshch. Isp. Prirody., Biol. Div.,* **81**(3): 31-37. (In Russian with English summary.)—Mutual parent and chick recognition was analyzed by nest observations of *Chlidonias nigra, Larus ribidundus, L. argentatus, L. ichthyaetus,* and *L. genei.* Mutual recognition was apparently established by the time broods left nests. Mutual non-recognition during early growth may have reduced mortality through general indiscriminate protection of broods by adults. And apparently recognition was based on individual vocal tones. Before fledging, adult recognition was apparently guided by position and appearance of the nest, not those of the young.—Leon Kelso.

15. Distribution and ecology of the Kamchatkan Tern in Kamchatka. (Rasprostranenie i ekologiya kamchatskoi krachki, *Sterna camtschatica,* na Kamchatke.) E. Lobkov. 1976. *Z. Zhurn.,* **55**(9): 1368-1374. (In Russian with English summary.)—Seven pages are packed with miscellaneous facts discovered during a partial life history study. It was first found nesting in Kamchatka in 1973 and is now known to have colonies in many locales of lowland boggy maritime tundra. To the author its notable feature is behavioral. In foraging for food it flutters and hovers low over the water and occasionally alights to seize food. It does not plunge downward and submerge underwater as do other species of the genus.—Leon Kelso.

ECOLOGY

(See also 10, 15, 22, 25, 31, 40, 42)

16. Ecology, flowering phenology, and hummingbird pollination of some Costa Rican Heliconia species. F. G. Stiles. 1975. *Ecology,* **56**(2): 285-301.—The wet lowland habitats around Finca La Selva, Costa Rica, contain nine species of hummingbird-pollinated *Heliconia,* whose tubular flowers produce a significant portion of the energy requirements for nine species of hummingbirds. The hummingbirds are divisible into two groups, hermits and "nonhermits." The hermits have long, curved bills and forage by traplining. Nonhermits have shorter, straight bills and defend feeding territories. *Heliconia* species, similarly, are divisible into those species that specialize in attracting hermits and those that specialize in attracting nonhermits. The former species have long, curved corollas and grow in small, widely scattered clumps. The latter species have shorter, straight corollas and grow in large clumps that produce enough nectar to become economically defendable. Ultimately, the evolutionary choice of pollinator of *Heliconia* may be related to the plant's degree of self-compatibility. Species that require cross-pollination should opt for trapline pollinators. Unfortunately, there are no data yet on the degrees of self-compatibility for the La Selva species of *Heliconia.*

The paper also indicates many related and tantalizing research possibilities. For example, the growth of forest-dwelling *Heliconia* species is limited by dim light; they produce very small clumps. The plant's problem is how to attract traplining hummingbirds away from the streambeds where canopy-openings favor the larger clumps of other *Heliconia* species. Two forest species have ap-

parently solved this through convergence of blooming seasonality (all other species are markedly divergent).

Finally, such a constellation of closely-related species whose gametes are being transported to other species must have a hefty array of isolating mechanisms. Stiles shows that *Heliconia* species rely on hybrid sterility, habitat separation, different pollinators, coloration, pollen-deposition sites on the hummingbirds, flowering phenology, etc. to accomplish reproductive isolation.—Douglas W. Mock.

17. Predation of overwintering larvae of codling moth (Cydia pomonella (L.)) by birds. M. E. Solomon, D. M. Glen, D. A. Kendall, and N. F. Milsom. 1976. *J. Appl. Ecol.*, **13:** 341-352.—With use of logs placed in an unsprayed apple orchard inside and outside of wire cages after known numbers of codling moth larvae had pupated on them, reduction by bird predation was determined in different years to be from 94.7 to 95.6 percent. Blue Tits (*Parus caeruleus*) and Great Tits (*P. major*) were chiefly responsible for the predation. —Paul A. Stewart.

18. The Manx Shearwaters of Rhum. P. Wormell. 1975. *Scot. Birds*, **9**(2): 103-118.—The Inner Hebrides are the chief stronghold of *Puffinus puffinus* in Scotland. The large mountain top colonies are concentrated on the main peaks of Hallinal, Askinal, and Trallvall. Occupied burrows suggest a total population of about 116,000. Because non-breeding immature birds may occupy burrows, even a highly accurate hole count could not measure the breeding population exactly. Their nutrient-rich droppings produce a grassland of high grazing quality, named here "Shearwater greens." The fertile *Agrostis/Festuca* grasslands associated with the colonies of shearwaters provide a self-sustaining biome for a considerable variety of fauna and flora.—Leon Kelso.

19. Radiotelemetry of the microclimate of Hazel Hen snow shelters. (Radiotelemetricheskoe izuchenie mikroklimata snezhynkh ubezhischch ryabchika, *Tetrastes bonasia sibiricus*). A. Andreev and A. Krechmar. 1976. *Z. Zhurn.*, **55**(7): 1113-1114. (In Russian with English summary.)—A compact transmitter and recording pack, described and diagrammed, was attached to the grouse's back. The device was suggested by Southwick (*Condor*, **75:** 464-466, 1973) and by Vasey and Ellis (*J. Wildl. Manage.*, **38:** 142-148, 1974.) The temperature in the snow den was about 40°C above outside air, i.e., about −10 to +11°C at air temperature of −48°C. The heat production was derived from the bird and from underground water drifting over the soil surface. This latter factor is declared common to riverside soil surface in northeast Siberian winters.—Leon Kelso.

WILDLIFE MANAGEMENT AND ECONOMIC ORNITHOLOGY

20. History of the guano platform on Bird Rock, Walvis Bay, South West Africa. H. H. Berry. 1975. *Bokmakierie*, **27:** 60-64.—The author reports on the methods used and the tribulations encountered in catching and marketing bird guano, chiefly that of cormorants. From a money-losing venture in the early 1930's he developed, by the mid-1970s, a profitable business annually marketing as much as 650 metric tons of guano. Perhaps several entrepreneurs willing to endure ridicule and business difficulties, such as was reported to have been experienced by Berry, are what is needed to solve the problem with roosting congregations of blackbirds and Starlings in the southeastern United States.—Paul A. Stewart.

CONSERVATION AND ENVIRONMENTAL QUALITY

(See also 28, 40)

21. Waterfowl at effluent discharges in Scottish coastal waters. B. Pounder. 1976. *Scot. Birds*, **9:** 5-36.—Various species of waterfowl gathered to feed on domestic and industrial sewage, particularly sewage containing distillery wastes. No injurious effect on the birds was noted; however, a warning was sounded that the birds are attracted into situations where toxic industrial pol-

lutants are a continuing possibility and threat to the welfare of the feeding waterfowl.—Paul A. Stewart.

PHYSIOLOGY

(See also 5, 41)

22. Nectar characteristics and food selection by hummingbirds. F. R. Hainsworth and L. L. Wolf. 1976. *Oecologia,* **25:** 101-113.—Choice experiments were used to determine the effects of sugar and amino acid concentrations and of corolla length on foraging by hummingbirds in the laboratory, and the results compared with analyses of plant nectar composition. Species tested were *Archilochus colubris, A. alexandri, Lampornis clemenciae,* and *Eugenes fulgens.* Ecuadorian plants analysed contained nectar equivalent to 0.45–1.28 M sucrose. Of the 123 species analysed 90 contained sucrose+glucose+fructrose and 31 contained polysaccharides. Sugar concentration was best discriminated at low mean concentrations. Intake rates declined with corolla length. Experimental reduction of intake rates by lengthening the corolla on the more concentrated of two feeders eventually led to a switch to the less concentrated solution, but only at levels of intake well below those for birds maximizing their cost-benefit ratios in foraging. Adding amino acids to the sugar solutions had effects on concentration choice only at high amino acid levels (rejected). In sugar combination tests the results suggested selection against glucose-only solution and selection in favor of sucrose-glucose-fructose combinations.

Hainsworth and Wolf suggest that the failure of the birds to switch from the high to the low concentration feeders at the maximum cost-benefit ratio intake might be due to a supernormal stimulus situation. That is, selection might normally operate against the development of preferences for weak concentrations of sugar in nectars but never against preferences for high concentrations. Ultimately this effect should lead to co-evolution in hummer-pollinated plants; these should favor corolla length (and thus rate of intake) changes and not nectar concentration changes in reducing the impact of the hummingbirds' competitors on the pollination rate of the plant.

This is yet another significant paper from these workers' long-term study of hummingbird energetics.—Raymond J. O'Connor.

23. Effects of degree of fatness in broilers on other carcass characteristics: relationship between fatness and the composition of carcass fat. I. Bartov and S. Bornstein. 1976. *Br. Poult. Sci.,* **17:** 17-27.—Increasing the energy to protein ratio of the diet of broilers during growth caused increased fat deposition, with increases in the proportion of palmitic and oleic acids and a decrease in linoleic acid. The degree of saturation of abdominal fat was correlated with the degree of fatness (as measured at the skin), most strikingly so at low energy-to-protein ratios.

Similar results have previously been obtained for adult birds of wild species, e.g., by Morton and Liebmann (*Comp. Biochem. Physiol.,* **48A:** 326-335, 1974), although this passes unnoticed by Bartov and Bornstein. However, their paper does suggest to me that it might be fruitful to extend this type of work to nestlings in the wild, where parallels to the broiler study would have rather nice adaptive significance.—Raymond J. O'Connor.

24. Tissue damage at the injection site after intramuscular injection of drugs in hens. L. Blom and F. Rasmussen. 1976. *Br. Poult. Sci.,* **17:** 1-4.—A variety of drugs were injected into the pectoral muscles of White Leghorn hens. The birds were killed and the injection sites examined seven days later. Eight of the 13 preparations tested caused necroses at the points of injection.

This is clearly a matter of interest for those injecting hormones or other drugs into wild birds.—Raymond J. O'Connor.

25. The protein requirements of laying pullets with changing seasons in the tropics. J. S. Chawla, G. N. Lodhi, and J. S. Ichhponani. 1976. *Br. Poult. Sci.,* **17:** 275-283.—This study started on the premise that the protein requirements of laying pullets in the tropics were unlikely to be those recom-

mended from Temperate Zone studies. Using isocaloric diets containing from 12.8 percent to 21.6 percent protein, egg production increased with protein concentration up to 18.5 percent in summer but only up to 15.0 percent in winter; summer eggs were also lighter than winter eggs. These effects were due to a 20 percent reduction in food intake in summer, this requiring a compensating increase in protein concentration.

The estimates of protein requirements made by Chawla and his colleagues are about 25 percent higher than those made from the non-tropical studies. They indicate a need for some care in estimating the energetics of tropical nesting by wild birds from existing poultry study figures.—Raymond J. O'Connor.

26. The effects of exogenous oestrogen and progesterone on laying and nesting behaviour in the hen. A. B. Gilbert and D. G. M. Wood-Gush. 1976. *Br. Poult. Sci.*, **17:** 13-15.—Progesterone delayed oviposition (but not ovulation) by 24-48 hours and also interfered with nesting behavior in various ways. Oestrogen injections had no observable effects.—Raymond J. O'Connor.

27. Variations in the red cell picture during growth of goslings and chickens. A. Kostelecka-Myrcha. 1976. *Br. Poult. Sci.*, **17:** 93-101.—The erythrocyte number of domestic goslings was independent of age (over 6 to 42 days), but the volume of circulating blood decreased with age. In domestic chickens (1 to 57 days) both erythrocytes per unit volume and hemoglobin content increased with age, but hematocrit value remained constant, and erythrocyte size and their mean hemoglobin content decreased with age. These differences are related in the discussion to the lower weight-specific metabolism of the goslings.

The results of this paper seem to me significant in two ways. First, they suggest a mechanism accounting for the ontogenetic decrease in water index noted in nestlings of many wild birds. Second, the paper provides an approach to the study of nestling and chick metabolism that could usefully be extended to wild birds.—Raymond J. O'Connor.

28. The influence of sample size on the choice of method and interpretation of incubation experiments. K. F. Laughlin and H. Lundy. 1976. *Br. Poult. Sci.*, **17:** 53-57.—An equation is provided to relate a difference in hatchability between treatments to the sample size required to detect that change. The sample sizes required to demonstrate a difference are startlingly high, e.g., a 4 percent difference needs a sample size of 228 eggs per treatment group if mean hatchability is 95 percent, and a sample size of 612 eggs per treatment group if mean hatchability is 85 percent, in both cases for the $P = 0.05$ level.

The points raised in this paper are of major importance to ornithologists dealing with pesticide or other interferences with hatching success. The paper must be regarded as required reading for all in these fields.—Raymond J. O'Connor.

29. Chick embryo heart rate during the last week of incubation: population studies. K. F. Laughlin, H. Lundy, and J. A. Tait. 1976. *Br. Poult. Sci.*, **17:** 293-301.—Electrocardiogram records of individual chicken embryos were recorded throughout the last week of incubation. Heart rates differed consistently from individual to individual but were independent of egg size and of hatching times. Male embryos showed slightly (1-2 beats per minute) but significantly lower rates than did females. Heart rate declined (on average) from an average of 262 beats/minute at 14 days to a minimum of 250 beats/minute at 19.5 days but increased (and became markedly more variable) towards hatching.

The methods of this study are possibly too complex for field use with wild birds. Nevertheless they do seem to open up new possibilities for the study of precocial development.—Raymond J. O'Connor.

30. Inbreeding components of body weight and growth rate in Japanese Quail. A. D. Narayan. 1976. *Br. Poult. Sci.*, **17:** 225-230.—Body weights and rates of weight gain were compared for two lines of Japanese Quail and their reciprocal crosses. The parental inbreeding components were estimated separately for male and female parents. Only the maternal component proved important, and even it declined in size with age.

Narayan rightly points out that his results are made difficult of interpretation by his having, on financial grounds, to take his controls from early hatches and his crosses from later hatches.—Raymond J. O'Connor.

31. Efficiency of energy utilization of the House Sparrow, Passer domesticus. C. R. Blem. 1976. *Oecologia*, **25**: 257-264.—Blem presents a multiple regression analysis of 11 factors likely to influence (a) the efficiency of energy utilization and (b) the existence energy of House Sparrows feeding in the laboratory on various food mixtures. His analysis brings out a hitherto unsuspected importance for food composition (as distinct from its caloric content) in determining the two dependent variables. Protein content proved particularly important in this respect. Blem notes that recent modelling of avian population energetics indicates rather sharp sensitivity of the models to the birds' efficiency of food utilization. His results therefore seriously question the practice of assessing only the calorific values of foods in energetics studies.

I continue to admire Blem's ability to ask interesting questions about such a well-studied bird.—Raymond J. O'Connor.

MORPHOLOGY AND ANATOMY

32. On the morphology of the penguin middle ear. (K morphologii srednogo ukha pinguinov.) V. Anisomov. 1976. *Vestnik Moskovskogo Univ., Biol. Div.*, **1976**(3): 16-19. (In Russian with English summary.)—Two types of columellar attachment were found in the ossicles of the middle ear of four penguin species. In *Aptenodytes patagonica* the columella is attached to the tympanic membrane at two separate points; the ossified element does not touch the wall of the tympanic cavity. In *Pygoscelis adeliae, Eudyptes cristatus,* and *E. chrysolophus* the columella is attached to the tympanum by one plate "at some localized zone" and is in contact with the wall of the tympanic cavity throughout its length. "In all penguins the muscle *tensor tympani* is well developed and is innervated by a branch of the facialis nerve."—Leon Kelso.

33. A comparative study of the digestive organs of the Corvidae. (K sravnitelnomy izucheniyu organov pishchevareniay voronovykh ptits, Corvidae). N. Voronov. 1976. *Biol. Nauki*, **1976**(8): 51-55. (In Russian.)—The food and morphometric indices of digestive systems of six corvid species were analyzed. There emerged three ecological groups. The more carnivorous-insectivorous group, the Raven and Magpie, showed less muscular gizzards, longer duodenum, and heavier liver. The second group, the Rook and Common Jay, had the gizzard more developed, duodenum shorter, and liver smaller. The Crow and Jackdaw, in the third group, were rated more omnivorous and had digestive organ indices intermediate between those of the first and second groups.—Leon Kelso.

ZOOGEOGRAPHY AND DISTRIBUTION

(See 15, 40, 42)

SYSTEMATICS AND PALEONTOLOGY

(See also 36, 42)

34. Phenetic affinities of the Wood Thrush *Hylocichla mustelina* (Aves: Turdinae). A. R. Gibson, M. A. Gates, and R. Zach. 1976. *Can. J. Zool.*, **54**(10): 1679-1687.—Forty-nine skeletal measurements of 130 specimens representing 13 thrush species were subjected to Principal Component analysis to assess phenetic similarity of *Catharus, Hylocichla,* and *Turdus*; *Sialia* and *Myadestes* were included as well. Analysis yielded a linear allometric series from *Catharus* through *Hylocichla* to *Turdus*. *Hylocichla* was most similar to the *Catharus* group. A good phylogenetic hypothesis explaining the relationships of these groups remains to be made to complement these results. The usual relationship of Principal Components 1 and 2 to "size" and "shape" is skillfully examined with subsets of the data, as is the original conclusion. Most interesting

is the resulting allometric series and the very distinct grouping of *Sialia* and *Myadestes* separately from the rest. These results suggest that at least two adaptive modes exist in the thrushes of North America.—Paul B. Hamel.

35. Biochemical genetics and evolution of North American blackbirds, Family Icteridae. J. K. Smith and E. G. Zimmerman. 1976. *Comp. Biochem. Physiol.*, **53B:** 319-324.—Fifteen blood and tissue proteins from 215 specimens representing 35 populations of seven species were examined electrophoretically. The authors assumed that the proteins examined were a random sample of the genome and that alleles migrating at the same rates are homologous across species. Clusters resulting from the analysis based on Roger's (S) and Nei's (I) coefficients are congruent: *Sturnella* (2 species) and *Agelaius* form one group; *Molothrus, Euphagus, Quiscalus,* and *Cassidix* form the other. These conclusions agree with those of earlier workers using morphological data. Smith and Zimmerman suggest thet *Quiscalus* and *Cassidix* be merged into a single genus, which the A. O. U. has since done (*Auk,* **93:** 878, 1976). They further suggest that *Euphagus* also be merged into *Quiscalus*. Using Nei's coefficient, dates of divergence are calculated for all the species, placing radiation of these species since 160,000 yrs. b. p. during the Pleistocene. Two further studies are in order: first, an examination of the blood and tissue proteins of other icterids, especially *E. carolinus*; second, an examination of the routes by which quiscaline blackbirds have speciated during Pleistocene glaciations.—Paul B. Hamel.

EVOLUTION AND GENETICS

(See also 16, 42)

36. Explanation of large scale extinctions of lower vertebrates. K. S. Thomson. 1976. *Nature,* **261:** 578-580.—Thomson points out that diversification and extinction in numerous ordinal level groups of vertebrates and invertebrates have followed a symmetric temporal pattern. Diversification of genera is relatively rapid and is followed almost immediately by relatively rapid extinction. In short, maximum diversity is maintained for a relatively very short time only, and diversification and extinction rates are near mirror images of each other. He suggests that asking why simultaneous diversification occurred in the Devonian and Cretaceous may be more appropriate than asking why simultaneous extinctions subsequently occurred.—Paul B. Hamel.

FOOD AND FEEDING

(See also 16, 22, 25, 31, 42)

37. Predation on eggs of Capelin (Mallotus villosus) by diving ducks. G. Josaeter and R. Saetre. 1974. *Astarte,* **7**(2): 83-89.—Flocks of *Somateria spectabilis, S. mollissima,* and *Clangula hyemalis* foraged mainly in spawning beds at 25 to 50 m depth. By analyses of stomachs of these species, it was found that 25, 5, and 5, respectively, had fed almost exclusively on Capelin eggs.—Leon Kelso.

38. Summer food of the Purple Sandpiper (Calidris maritima) in Spitzbergen. S-A. Bengston and A. Fjellberg. 1975. *Astarte,* **8**(1): 1-6.—The stomach contents of 33 (including 10 juveniles) were analyzed and recorded relative to collection site. On lichen tundra, Diptera, Collembola, and spiders were eaten. On wet shores mainly gastropods and amphipods were eaten. The stomach contents simply reflected habitat. As birds shifted from dry to marine locales they moved from arthropod to molluscan items. The males took charge of broods as soon as the young hatched, while the females assembled on the shores. Evidently to complete the life cycle "on the lichen tundra of Spitzbergen the Purple Sandpiper has to depend on food resources in other habitats, chiefly the marine shores."—Leon Kelso.

PHOTOGRAPHY AND RECORDINGS

39. Les Oiseaux de l'Ouest Africa. C. Chappuis. 1974-1975. *Alauda Supplement Sonore,* Disque nos. 2-6. Societe d'Etudes Ornithologiques, Rue d'Ulm, 75230 Paris, Cedex 05. Each disc price to overseas nonmembers, 70 Fr; subscription price to members, 30 Fr.—This 33 1/3 rpm phonograph album continues a comprehensive series of recordings of songs of birds of West Africa. Disc 1, reviewed in *Bird-Banding* (**46:** 186-188), gave us cuckoos and doves. Disc 2 gives *Cisticola* warblers. Disc 3 includes hornbills, kingfishers, bee-eaters, rollers, and some sylviid warblers (*Prina, Heliolais, Urolais*). Disc 4 includes flamingos, ducks, rails, the finfoot, grebes, and jacanas. Disc 5 has the songs of timaliids and pycnonotids (*Pycnonotus, Criniger, Bleda, Pyrrhurus, Baepogon,* and *Phyllastrephus*). Disc 6 presents the remaining pycnonotids (including *Neolestes torquatus* and *Ixonotus guttatus*) and part of the thrushes (*Turdus,* rock thrushes, wheatears, ant chats, and *Saxicola* chats). The recordings are all of good quality and represent a considerable field accomplishment for Chappuis, who taped most of the birds himself, although contributors have added many species (R. Stjernstedt's recordings of birds from Tanzania, Zambia, and southern Zaire are especially notable). Accompanying comments on locality, date, supporting evidence for identification of several species, and technical equipment are published in reprint form as a "supplement sonore" to *Alauda* (**42:** 467-500, 1974; **43:** 427-474, 1975) enclosed in the album.

The recordings are useful in identifying the songs of African birds and in presenting behavioral data towards an understanding of the relationships of races, species, and genera. The *Cisticola* section includes a key to *Cisticola* song structure. Songs of the Rattling Cisticola (*C. chiniana*) are distinct from those of the Boran Cisticola (*C. bodessa*), now recognized as a new species; they are mutually exclusive on their territories. *C. rufa* is slower and has notes of purer tone than *C. brachyptera.* Chappuis proposes two new species based on song; *C. mongalla* (song distinct from *C. ruficeps,* of which it was earlier described as a subspecies; both occur in Nigeria but are allopatric with some habitat differences) and *Prinia fluviatilis,* described here as a new species apparently coexisting with *P. subflava* in Chad. Types of *P. fluviatilis* have been deposited in the Paris Museum but a description of the types has apparently not yet been published. Several Palearctic recordings are included for species that breed in the north but migrate and sometimes call or sing in Africa. In particular for the forest babblers and bulbuls, Chappuis compares several closely related forms and comments on their probable species relationships as judged from their song similarity. The allopatric *Trichastoma albipectus* and *T. cleaveri* are nearly identical in voice and may be conspecific. Many forest species with populations in the separated Upper and Lower Guinea forests have no distinctive differences between these forest blocs, although a few (*Phyllastrephus albigularis*) have song differences from one bloc of forest to another. We look forward to the continuation of this fine series of recordings of the songs of west African birds.—Robert B. Payne.

BOOKS AND MONOGRAPHS

40. The Handbook of Australian Sea-birds. D. L. Serventy, V. Serventy, and J. Warham. 1971. Sydney, A. H. and A. W. Reed. 254 p. illustr. (Imported for sale by Chas. E. Tuttle Co., Rutland, Vermont.) $18.50.—The delayed introduction of this excellent book into the United States is indeed unfortunate. It serves as a field guide as well as major reference, ranking with R. Palmer's "Handbook of North American Birds," and will be of interest to both the amateur and the professional.

Five Sections are included: (1) a concise, useful discussion of the physiography and geography of the Australian marine habitat comparing water masses, currents, temperatures, productivity, and a discussion of the Pleistocene and post-Pleistocene coastlines; (2) a fine general summary of the sea-bird fauna that reflects the full understanding possessed by the authors of the biology of these birds; (3) brief notes on past and present research on Australian sea-birds; and (4) conservation problems. The fifth and longest section contains the systematic accounts of species found in Australian waters and is the bulk of the book, comprising 193 pages. The reference section will be extremely useful through 1970.

However, data from one paper discussed in the text but not by citation (p. 156) are not included (Sibley and Clapp, *Ibis*, **109:** 328-337, 1967). The index worked well for me. I should point out that considerable work has been accomplished on sea-birds since the publication date, adding to the extensive data summarized in this book.

The discussion of the sea-bird fauna purposely raises many questions, which need to be answered through careful research, and contains an excellent account of the proventricular oil in petrels, interesting notes on diseases and other natural hazards, and a really neat comparison between the shag-frigatebird skull and the Cheatle forceps (Fig. 14, p. 30). However, the supra-orbital gland is not located "in a groove over the eye" (p. 26) in all species, and I doubt if the plumage water logging of the Sooty Tern is "owing to the inefficiency of the preen gland" (p. 29)—another subject worth further study. I wonder if it is still true that Australia has been spared from oil pollution (p. 36). And, has the cray-fishery of Australia really increased primarily in response to American demands (p. 42)?

The species accounts reflect the expertise of the authors on penguins, petrels, and shearwaters. The other species are not slighted, and if they receive lesser treatment, it is because of the lack of data on the species, not only in Australia but elsewhere. The better known birds receive fuller coverage, based primarily on the authors' experience. As stated in the introduction, data from outside Australia generally are not included, but this does not detract from the accounts. However, the use of non-Australian references appears to be inconsistent. Some are included, and properly so (i.e., Robertson, *Nature*, **223:** 632-634, 1969) but others are not. The format of the species accounts is: field characteristics and general habits, measurements, status, voice, display, migration, enemies and mortality, food, breeding (season, egg, incubation, nestling), and breeding distribution. These sections are nicely balanced. For example, the well known displays of *Aptenodytes patagonica* are merely referenced to the major paper by Stonehouse, but poorly known ones of the popular and ubiquitous *Larus novaehollandiae* are illustrated and described in some detail. Most species are illustrated with a black-and-white photograph, and many useful aids in identification are figured. These illustrations are well placed in the text, and the data in the tables are extremely useful.

The photo on page 144 of *Pelagodroma marina* walking is interesting. The condition of the band on the *Puffinus gavia* on page 134 would not satisfy our Banding Office. Certainly the frigatebirds wander as much as the gannets (p. 153), and I believe it unfair to describe frigates as parasitic (p. 153). The authors use *Phaethon rubricaudus* whereas Peters *Check-list of Birds of the World* (1931) and all other recent works I know of use *P. rubricauda.*

This book is extremely useful and is a valuable addition to my library. I recommend it highly.—Ralph W. Schreiber.

41. Avian Physiology (third edition). P. D. Sturkie, editor. 1976. New York, Springer-Verlag. 400 p. $23.80.—This book is an extensively rewritten and updated revision of Sturkie's classic textbook, which made its appearance in 1954 and, in a second edition, in 1965. As with the subject itself this edition has expanded in size, although the larger page size and smaller type size have nevertheless permitted a volume with fewer pages than previously. The major changes since the second edition are the introduction of chapters by Griminger on lipid and protein metabolism and the omission of a chapter on the chemical constituents of the blood. Additional changes in the contributors revising or extending particular chapters make this a substantially different book from the second edition.

Of the 21 chapters Sturkie himself has written nine, six as sole author and three in collaboration with other specialists. The former cover the topics of circulation, heart function, alimentary canal, digestive processes, kidneys, and the hypophysis. Throughout these chapters Sturkie writes clearly but rather dryly (in my view) for a student text, with frequent repetition of the same point under different headings. Thus sex differences in blood pressures are stated on p. 82 and again on p. 89. This type of repetition makes for ease of consultation given a topic of interest but makes for episodic reading when the volume is viewed as a textbook. Sturkie's other chapters cover accounts of blood, of reproduction and egg formation in females, and of reproduction in males, and have largely been written by Sturkie himself.

The other chapters of the book have varied authorship and are rather uneven in quality. A clearly presented introduction to the avian nervous system by Bolton is followed by an excellent account by Kare and Rogers of current knowledge of sense organs in birds. This is particularly useful as student reading because it effectively debunks the notion that one can learn about sense organs in *the* bird. Instead intraspecific differences in sensory physiology are realistically accepted in this article for what they are, an important source of adaptive adjustment to ecological pressures. Fedde provides an account of avian respiration, which I found heavy going, although his torturous sentences are partly relieved by good illustrations. Whittow contributes a well-thought out review of the regulation of body temperature, but his chapter on energy metabolism is cursory. Growth, for example, is considered only in precocial chicks, and Ricklefs's work in this field over the last decade is ignored completely. The discrepancy between the quality of these two chapters is curious.

Three chapters of the book deal with metabolism, respectively of carbohydrates, proteins, and lipids. Hazlewood (who also provides a short account of the pancreas elsewhere in the book) had revised his 1965 chapter on carbohydrates to provide an up-to-date synthesis of present knowledge in this field. To my mind this is one of the better chapters of the book, providing a coherent review of the field at a level acceptable to students. Griminger's account of protein metabolism in the following chapter is less satisfactory. It is sound but lacks the cohesion of Hazelwood's writing. Perhaps this is in the nature of the topic, for I thought his second chapter (lipid metabolism) is altogether clearer. The remaining chapters of the text are by R. K. Ringer and deal with the thyroids, parathyroids, and adrenal and pineal bodies.

A book such as *Avian Physiology* can serve either as a reference work or as a textbook, and the earlier editions of this work have filled both needs very well. However, in the former role it must now compete at various points with Farner and King's five volume *Avian Biology* and with Bell and Freeman's more specialized *Physiology and Biochemistry of the Domestic Fowl*. Here I suspect Sturkie's book will no longer be satisfactory. The more extended treatment possible in the multivolume work makes for greater and deeper coverage than Sturkie can provide for the research worker. In addition *Avian Biology* discusses work on wild birds whereas much of Sturkie deals with the domesticated or laboratory-amenable species. As a textbook, however, Sturkie's book is still the leading contender. Despite its drawbacks—the uneven quality of its chapters, the cataloguing rather than synthesizing of effects, the differing levels of writing—it remains an admirable work and can be recommended as a replacement for the now dated second edition, and this despite its competitors.—Raymond J. O'Connor.

42. Owls of the World—their Evolution, Structure, and Ecology. John A. Burton (ed.). New York, E. P. Dutton and Co. 216 p. $17.95. (Paperback: New York, A and W Visual Library. $9.95, $10.95 in Canada).—Part I explores the role owls have played in human society through time, the early evolution and fossil record, and the adaptations that owls possess as predators. It is well illustrated and written except for a couple of antropomorphisms, which creep into the first chapter; e.g., "An owl, too, is equipped with *cruel* talons. . . ." As a biologist I view them as efficient adaptations for a predator. The "*murderous* talons," referred to later on the same page, likewise suggested tools used for wanton killing of other creatures rather than adaptations that insure survival of the possessor by effectively aiding it in the securing of food.

The six chapters of Part II discuss the taxonomy and, to a lesser extent, the ecology of all known species of owls in the world today. All but the possibly extinct Laughing Owl (*Sceloglaux albifacies*) of New Zealand are pictured with photographs or color paintings, which speaks well of the throroughness of the various authors and the editor. The final two chapters of Part II (conservation and owl pellets) very nicely conclude the text by providing a very important "bottom line" for the book. This is the need for much more research on the autecology of many owl species, the significance of owls in ecosystems, and the hazards they face because of their role in the ecosystem (e.g., their high trophic level position subjects them to concentrated doses of non-biodegradable pollutants coming through the food chain [biological magnification] and places them in competition with man for game species). Lastly, persons wishing to learn more

about owl species' food habits can do so by applying methodological information from the last chapter on owl pellet analysis, which discusses both procedures and pitfalls of this process.

Part III includes a species check-list, discussion and description of owl vocalizations, brief glossary (22 items), and a list of books for further reading. Brief autobiographical sketches of the 13 authors (including editor) and an index are also included.

There are relatively few errors. For example, the Rufous Fishing Owl (*Scotopelia ussheri*) is said to have yellow eyes (p. 72) in the text, whereas the photograph of the species (p. 69) shows dark brown eyes (is this an age difference?). On the distribution map of the Puerto Rican Screech Owl (*Otus nudipes*) (p. 95) the yellow of the map does not match the green of the legend. The legs of the Cuban Screech Owl (*Otus lawrencii* (=*Gymnoglaux lawrencii*), (also p. 95) are a brownish off-white instead of yellow. The statement that ". . . Barred Owls . . . always attack animals or people who approach their fledgling or nest" is contrary to the reviewer's experience. The distribution map for the Fearful Owl (*Nesasio solomensis*) (p. 160) is erroneously labeled *Nesasio solomonis*, increasing the confusion with the New Ireland Hawk Owl (*Ninox solomonis*), also discussed in the same section.

Occasionally the reader is tantalized by discussions that warrant further explanation, e.g., "Apparently reliable reports of barn owls glowing in the dark are possibly explained by lunimous bacteria, from decayed wood, adhering to the plumage." Is this the explanation for the feather phosphorescence observed in other species, e.g., *Bubo virginianus*?

In discussing whether or not the Pharoah Eagle Owl (*Bubo bubo ascalaphus*) of the Middle East warrants specific status the author suggests it remains "largely a matter of taste whether they [comparing it with the nominate species of *Bubo*] are regarded as separate species or not." This brings up the question—just how do ornithologists determine what constitutes a species? This is not touched on even though the book freely talks about species, subspecies, forms, clinal variations, and the like. Definitions are noticeably lacking. Likewise, the clinal "rules" (i.e., Gloger's, Bergmann's and Allen's) are frequently discussed in principle but never named or defined. Finally, faunal zones are named (as well as Wallace's line), but neither their boundaries nor their significance is discussed. In summary, I feel the authors have done quite well in delineating the "trees" but the reader is left with a very fuzzy picture of the "forest" of Strigiform biology.

The book does a fine job for the laymen, excepting those limitations listed above, and would have found a much wider audience with a few additions: (1) documentation with author-year citations, which detract little if any from the readability of the text, and (2) an expanded "Books for Further Reading" section.

The cover of my copy of the paperback edition broke loose from the binding after a few days of constant use in reading the book for review.

All in all, however, considering the many fine color plates and the comprehensive coverage of species, this is a lot of book for the money, and it should make a valuable edition to the library of serious birders and professional biologists.—Richard J. Clark.

43. Birdwatcher's Guide to Wildlife Sanctuaries. Jessie Kitching. 1976. New York, Arco Publishing Co., 233 p. $8.95.—This compact guide provides brief site descriptions for nearly 300 National Wildlife Refuges, National Parks, and other wildlife sanctuaries of the United States and Canada. The essence of the book's text is based on check-lists of the birds of each area. The site entries are arranged by State or Province and with a telegraphic style. Entries average half a page. Generally each site description contains part or all of the following information. It provides the sanctuary name, mailing address, and highway location. Local check-list details are summarized, with the number of species and brief (sample) listings of both rare and common species. Often a seasonal preference is indicated. There are short notations of the sanctuary habitats, special facilities (e.g., camping areas), and regulations or precautions. A concluding comment gives the date and availability of the local check-list.

As a whole the guide will be useful for traveling birdwatchers, both for logistic aid and ornithological guidance. The listings of the common birds characteristic of each sanctuary are most useful. You can realistically plan successful trips

around these dependable species. The listings of the rare and endangered birds are often of mixed value. Sometimes the birds are observable (e.g., the Whooping Cranes at Aransas), but many of the "rare" species are simply that, regional accidentals unlikely to be recorded by a visitor. The latter birds promote unrealistic aspirations and would best be deleted from the guide. The other information in an entry is thoughtful and limited in its usefulness only by brevity. (For example, "yield right of way to buffalo on highway"!) Throughout the text are scattered an assemblage of ordinary bird and scenery photographs.

Kitching's guide will be welcomed by many outdoor people, but especially by the listing birders. It is, of course, much briefer that the two volumes of bird-finding by Pettingill and thus lacks, for example, State or regional overviews. Nevertheless, it is current and vacationers on birdwatching tours will certainly benefit from this inexpensive book.—Charles Leck.

44. The Lapland Reserve. (Laplandskii zapovednik.) O. I. Semenov-Tyan-Shanskii. 1975. Murmansk Press. 244 p. Price uncertain. (In Russian).—Of over 86 reserves in the USSR this is the most important of those above the Arctic Circle. All hunting, fishing, and other exploitation of nature are forbidden. It maintains a staff of 60 persons, including 6 research scientists and 28 aides of the forest service. The 21 chapters in this compact and well-designed book cover a wide range of topics: Lapland and its original inhabitants; History of the Lapland reserve; Topography; Water drainage; Climate; Plant and animal world of waterways, of the forest zone, of mountain tundra; Forest fires and burns, Native northern reindeer, Tetraonid birds, Lemmings and voles, Fur bearers, Moose and bears, and Beavers and acclimatized fur bearers.

The writer's account, as avowed by Russian readers, is vivid and engaging, with memorable word and photographic portraits of nature in the north, interlarded with the dangers and delights of the enchanting work of a naturalist living the year round in arctic reserve. The Lapland Reserve was founded in 1930 to save some wilderness for survival of the wild northern Reindeer, as distinct from the domesticated form. From a stock which had declined to about 100 head, management and protection lifted the total to over 20,000 by 1969 on the Kola Peninsula. The present reserve area covers about 160,000 ha of which more than half is timber, but little less than a third montane tundra, and the rest dwarf birch or other timberline shrubbery. There is an abundance of bogs, lakes and rivers, rich in plant and animal life but complicating human travel. Among the timber plots are "burns," which requiring many years for renewal leads to emphasis on forest fire protection. For this, a special chapter is devoted. Long-term research, employing automatic nesting actograph recording, was developed by the author for studies of tetraonid species, particularly, Capercaillie (*Tetrao urogallus*) and Black Grouse (*Lyrurus tetrix*). About 70 species of birds are recorded. If only for their importance in the food chains and cycles of the fur bearers and avian raptors, the Norway Lemming and other rodents demand a chapter. Located at one of the main locales of such lemming outbreaks or "eruptions," the Lapp reserve has occasion to witness them, analyze their manifestations, and discuss the possible ultimate cause, without arrival at any generally accepted explanation for them. This book is excellently produced and is of convenient pocket-size. As an innovation, in this reviewer's experience, footnotes and picture titles are set in fine print in the ample margins of the text pages. The author and collaborators after over 30 years of experience have recorded and accounted for about all in nature except the mineral elements in this remarkably thorough production.—Leon Kelso.