ORNITHOLOGICAL LITERATURE

HANDBOOK OF NORTH AMERICAN BIRDS VOLS. 2 & 3 (WATERFOWL). Edited by Ralph S. Palmer, illus. by R. M. Mengel & C. H. Nelson. Yale Univ. Press, New Haven, Connecticut, 1976: 1081 pp., 8 color plates, 53 range maps, 103 uncaptioned line-drawings. $60 the set—These volumes form the second part of the "Handbook of North American Birds" of which Volume 1 (Loons through Flamingos) appeared in 1962. The editor remarks that the Anatidae are already the best known avian family, so it is not surprising that there are over 1000 pages of closely-set type and nearly 2000 references. The aim has been to enable the reader to "determine what a bird of either sex, or any annual increment to the population, looks like and is doing at any time of year." The volumes deal with 18 genera and 64 species, 6 of which (the Cuban Whistling Duck, Red-breasted Goose, Ruddy Shelduck, Common Shelduck, Garganey, and Spotbill) rate only about a page, and a few others (such as Whooper Swan, Barnacle Goose, Mottled Duck, Baikal Teal, Falcated Duck, and Bahama Pintail) are not given very lengthy treatments, usually because they are accidental or at the edge of their range in North America.

Twenty-nine authors, in addition to the editor, wrote the text. This does not claim to deal thoroughly with such topics as agricultural damage, habitat improvement, hunting, aviculture, domestication, parasites, disease, lead and pesticide poisoning, navigation, internal anatomy, or genetics. Instead, plumages are very fully covered, and distribution, migration routes, banding recoveries, voice, display, breeding biology, food, and hybrids are considered in detail.

The taxonomic arrangement is that of Delacour's Waterfowl of the World (1954-59) rather than of Johnsgard's Handbook of Waterfowl Behavior (1965), so that the dabbling ducks are preceded by the shelducks and followed by the eiders, and the perching ducks come between the scaup and the scoters. At the specific level Palmer has, however, altered Delacour's classification somewhat. The Whooper and Trumpeter swans are treated as separate species, while the Whistler and Bewick's swan are amalgamated into the "Tundra Swan." The Canada Goose is split into 8 trinomials, 4 fewer than Delacour (*leucopareia* is included with *asiatica*, *parvipes* with *taverneri*, *fulva* with *occidentalis*, and *maxima*, which was only rediscovered in the 1960's after having been extinct for most of this century, has again been lost, this time into *moffitti*). There are 7 rather than 5 subspecies of the Common Eider, and the Mottled Duck and the Mexican Duck are given specific status instead of their more usual position as races of the Mallard.

With so painstaking a textual treatment of plumage, it is surprising that there are not colored illustrations of all species. There are about 100 line drawings by Robert Mengel and 5 color plates depicting plumages of white and blue phases of the Lesser Snow Goose, North American Wood Duck, Oldsquaw, Common Eider, and Masked and Ruddy duck. Almost all Mengel's illustrations are based, apparently, on layouts prepared by the editor with emphasis on Palmer's own photographs. They are both useful and decorative, and often catch the magic of waterfowl delightfully. Equally charming are the 3 color plates by Coleen Nelson of the young of 32 species, done from life. The range maps are good (although I should have liked the large river systems marked in), and well adapted to the particular species being dealt with. Parts of Asia are figured if necessary, and Greenland is included in its entirety.

How good is the detail? On the whole, it is extremely useful, especially the coverage of Russian and Icelandic literature. There is, for all that, tendency to say "more

interesting data can be found in. . . ." or "for some information on habits see. . . .". Sometimes an author and date seem to have been added to Palmer's text as a publication came to hand, without much effort being made to abstract the information it contained. I want to know the bases on which it was decided that the Whooper and Trumpeter are not conspecific—the "fact" is repeated in one form or another 4 times—while the Bewick's and Whistler can be lumped. I find a statement such as "Witherby is still very useful, aside from serious errors in 'Description'," unhelpful. *What* errors exactly?

Typographical slip-ups are few and unimportant (there is, however, a mistake in the key to the Redhead map). Errors of fact also seem infrequent; however, it is not true that all 3 *Cairina* "do well" in captivity: captive White-winged Wood Duck only started breeding regularly in 1971, and Hartlaub's Duck has proved almost as difficult. Nor are 2 *Mergus* species believed extinct. It is stated that the male Fulvous Whistling Duck averages slightly larger than the female, but neither the weights nor measurements given bear this out. Similarly, the Mute Swan egg weights from Rhode Island don't really agree well with the Old World figures, although Palmer says that they do. It wasn't the Brown Duck that Milton Weller described as having hardened skin at the corner of the gape to protect it while eating spiny isopods, but the Auckland Islands Flightless Teal.

It is clear that these volumes will be contrasted with the recently published *Waterfowl of North America* by Paul Johnsgard, and the revision of Kortright's *Ducks, Geese and Swans of North America* by Frank Bellrose. In terms of straight information, Palmer stands the comparison well. His volumes are nearly twice as long (and twice as expensive), although a great part of the extra information is in the Description section—plumages are *exceedingly* well covered. Bellrose has produced a book with almost as many facts, which less often loses the intrinsic fascination of its subject. Johnsgard's book is the easiest of the 3 to read and has the most attractive layout, but has decidedly less coverage of the recent literature. Palmer does not give the impression (which Johnsgard and Bellrose do) of being a field biologist who understands waterfowl: he is basically a compiler. Geese and swans are said to sometimes post "sentinels" around the flock; does Palmer really believe that? The detail is often there, but it is not always evaluated. The taxonomic sequence that he has adopted, for instance, means that some evolutionary interest is lost or muddled.

Are the volumes easy to use? Unfortunately, not particularly. There are too many abbreviations for rapid comprehension, and yet there *are* repetitions of information that, if eliminated, could have given the space to spell place names in full. The layout is poor, and headings of sections on, for example, plumages or subspecies are much too timid for clarity. For body weight, grams or kilograms are used alongside (and translated into) pounds or ounces, and even into tenths of a pound and tenths of an ounce, and yet body lengths, egg dimensions, and weights of day-old young are given only in metric units. So why not, in a scientific work, where space is short, give the original published figure and translate into standard metric only if it isn't in that form already?

In summary then: these are 2 expensive and rather dull volumes with a wealth of useful detail and numerous references. For having assembled it with so few errors, Palmer and his collaborators are to be thanked and congratulated; at times the project must have seemed a monumental burden.—JANET KEAR.

AVIAN BIOLOGY, Vol 5. By Donald S. Farner & James R. King (eds.). Academic Press, New York and London, 1975: xxii + 523 pp., many charts, graphs, and drawings. $49.50—This concludes a treatise reviewing established ideas and recent advances in avian biology that was initiated with the publication of volume 1 in 1971. Many of the important findings discussed in this final volume were discovered since the publication of the first 3 volumes in the series. Volume 5 contains 7 contributed chapters: Mechanics of Flight (C. J. Pennycuick), Control and Metabolic Physiology of Migration (P. Berthold), Orientation and Navigation of Migratory Birds (S. Emlen), Circadian and Circannual Rhythms in Birds (E. Gwinner), Vocal Behavior in Birds (F. Nottebohm), Incubation (R. Drent), and Zoogeography (F. Vuilleumier). The last 3 topics have nothing to do with the previous 4, and I cannot see why the topics were grouped in this manner. The vocal behavior of birds and avian incubation would have been more appropriate in volume 3 with the chapters on reproduction and behavior in birds. The zoogeography chapter would have been appropriate in volume 1. As in the previous 4 volumes the quality of the contributions is generally good, but some fall a bit below average while others are well above average.

Pennycuick's chapter is by far the most technical and is in part a review of his model of the mechanics of flight published in 1969 (Ibis 111:525–556) and a discussion of Tucker's suggested modifications (J. Exp. Biol. 58:689–709, 1973). The second half of Pennycuick's chapter examines the mechanics of gliding and soaring, and has a brief closing discourse on the loss of flight. The chapter is relatively hard reading, undoubtedly the product of the 71 equations in the paper. I am still pondering the differences in Figs. 2 and 3; although the legends are different the figures appear identical. It is unfortunate that Pennycuick did not have the chance to include a recent paper by Crawford Greenewalt on the flight of birds (Trans. Am. Phil. Soc. 65: 1–67, 1975). This paper is well written and is an excellent complement to Pennycuick's contribution. I cannot understand why Berger and Hart's chapter on the physiology and energetics of flight in volume 4 of *Avian Biology* is not referenced by Pennycuick. This omission shows a lack of communication on the part of the contributors that the editors should have discouraged.

Berthold's chapter is an exhaustive literature review on migratory restlessness (*Zugunruhe*) in birds and its environmental and physiological control. Some attention is paid to migration in the field, but the emphasis is on cage studies. In the section on climate, weather, and food supply (pp. 82–83) there is an unfortunate perpetuation of terms that I had hoped were well on their way to oblivion (e.g., instinct migrants, typical migrants, and rush migrants). A more rigorous ecological and evolutionary treatment of migration would have markedly enhanced the subsequent sections on control and metabolism. Although Berthold does a good job reviewing the available information through 1971, there is no reference to works later than 1972. In an effort to correct this problem, almost 4 pages of additional references are listed at the end of the regular bibliography but are not discussed in the text. Because of the many references in Berthold's chapter, there is a tendency toward abbreviated critical comment and limited synthesis. It might have been better to have had fewer references and more analysis of the recent information. Many of the older references have already been treated by Farner in *Recent Studies in Avian Biology*, 1955, and in *Grundriss der Vogelzugskunde* edited by E. Schuz, 1971. The review of migration physiology is in general well done, but there is a lack of integration among physiology, ecology, and evolution. Berthold knows a great deal about the physiological control mechanisms of bird migration, and I would have valued more discussion of the adaptiveness or ecological determinants of the various mechanisms.

Emlen's chapter is in my estimation the best in the volume if not in the entire series. His treatment is so up-to-date that some of the material reviewed in detail was published after volume 5 was published! The material is presented in a readable style and is very comprehensive. I am, however, surprised that Bellrose's paper on the evolution of orientation mechanisms (*Animal Orientation and Navigation*, NASA SP-262, pp. 223–257, 1972) was not included in the review. Emlen's philosophy of orientation research is well stated; he believes that those investigators searching for *the* mechanism of bird orientation are misguided. The evidence suggests overwhelmingly that many orientation cues are used by migrating birds. Emlen examines displacement experiments with free-flying birds and caged migrants and concludes that it is too soon to look for generalizations about the navigational capabilities of birds. He suggests that a whole array of navigational strategies may exist. The section on direction-finding cues is quite complete and contains the latest information on the possible use of geomagnetism. However, the subject of reverse migration is not covered; this is unfortunate because the implications of this phenomenon on orientation mechanisms may be quite important. The many questions Emlen raises in this review will undoubtedly stimulate research for many years to come. This chapter complements the recent paper by Keeton (*Advances in the Study of Behavior*, 5:47–132, Academic Press, 1974) on homing in birds, and both provide the best reviews available on bird orientation and navigation.

The contribution by Gwinner on circadian rhythms is quite thorough and covers most of the literature through 1974 with at least one "in preparation" citation for 1975. Gwinner examines the properties of circadian and circannual rhythms under constant conditions, covers their entrainment, and concludes with a discussion of their adaptive functions. Circannual rhythms were first demonstrated in birds by Merkel (*Proc. 13th Int. Ornithol. Congr.* 13:950–959, 1963), and since then many studies have confirmed that birds in a constant photoperiod go through their annual cycles with a periodicity of about a year. These rhythms have been shown to be adaptive; e.g., the length of time a caged bird shows migratory restlessness in the fall is related to the distance it must travel to reach its wintering ground. Although Gwinner does not include references to the bird papers in a recent book edited by E. T. Pengelley (*Circannual Rhythms*, Academic Press, 1974), his review is by far the most comprehensive on the subject of circannual rhythms.

In the chapter by Nottebohm not only is the adaptive significance of call and song structure discussed, as one would expect, but the anatomy and phylogeny of song development are also reviewed in a very readable style. Nottebohm emphasizes the need to follow descriptive accounts of vocal repertoires with statistical treatment of signaling context and consequences, and he urges study of the correlation between social systems and vocal repertoires.

Drent's chapter on incubation ably covers length of incubation period, the brood patch, physical optima for development, the parent as an incubator, hatching, and energetics of incubation. His emphasis is on the field approach. The chapter is an inventory of problems and phenomena rather than an exhaustive compendium of facts about incubation. It is well written, and the numerous graphics are exceptionally well done. In the section "the parent as an incubator" Drent covers the regulation of incubation temperature, egg turning, the adaptiveness of the nest, nest tending in the Megapodes, and antipredator behavior. He then summarizes these interrelated topics in a final discourse on the organization of incubation behavior. I believe this is Drent's most successful section, but his review of the energetics of incubation, the final section in the chapter, covers some of the newest information to come out of research on incubation.

He concludes that parental costs of incubation probably have upper limits of 20–25% of productive energy. Once again, 1975 "in preparation" citations in the reference section attest to the completeness of Drent's up-to-date review of incubation, but the omission of Ricklefs' review (*Avian Energetics*, Nuttall Ornithol. Club, No. 15:152–297, 1974) because of its late publication date is unfortunate.

In the final chapter Vuilleumier reviews the current status of research in zoogeography. The fresh approach currently underway in recent work is immediately recognizable. New understanding in community and population ecology with reference to dispersal, invasion, competition, adaptation, and extinction has had a tremendous impact. This, coupled with the theory of plate tectonics and the acceptance of continental drift, has injected new vitality into the study of zoogeography. It is refreshing to read of *r* and *K* selection, equilibrium values, and extinction rates in a chapter devoted to zoogeography. Vuilleumier, however, emphasizes that the break from more traditional zoogeography is only a beginning, and empirical studies are badly needed. His review will, I hope, provide the necessary impetus to get these studies underway. In an effort to make his review up-to-date Vuilleumier has included at the end of the reference section 7 additional references that were probably added when the galley proofs for his chapter were in hand.

No review would be complete without some cursory attention to errors. I found no glaring factual errors, but some minor ones were noticeable. For instance, in Pennycuick's chapter the Parrott reference should be 1971, not 1970, and in Berthold's review the term "isepeptises" on page 82 should probably be isopiestices or isobars. In Emlen's contribution those references from the *Proceedings of a Conference on the Biological Aspects of the Bird/Aircraft Collision Problem* (Able 1974b, Emlen 1974, Williams et al. 1974) contain several errors. In all those citations "Clemsen, North Carolina" should be Clemson, South Carolina, and whereas the Able and Emlen references correctly identify the Air Force Office of Scientific Research, the Williams et al. reference has Naval Office of Scientific Research. Although the latter errors were very noticeable to me because I edited these Proceedings, I wonder how many other errors, less obvious to me, are contained in the lists of references. These, however, are small points and should not detract from the overall significance of the contributions and the success of the volume. I feel it is the best of the series, and it is definitely the most expensive—approximately ten cents a page!—SIDNEY A. GAUTHREAUX, JR.

AVIAN PHYSIOLOGY: Symposia of the Zoological Society of London, No. 35. Edited by Malcolm Peaker. Academic Press, London and New York, 1975: 377 pp. $25.50—The editor invited papers from those "working primarily on domesticated species...," but this should not turn away the ornithologist for over half of the chapters are comparative in scope, and the rest are concerned with basic physiological problems.

In "Recent advances in digestive physiology of the fowl," K. J. Hill and P. J. Strachan begin with a brief review, then discuss their research on birds with re-estrant fistulae. "Motor activity of the digestive tract," "ingesta flow along the duodenum," and "interrelationships between crop and gizzard" are the subtopics.

M. J. Purves points out the general paucity of quantitative knowledge about "the control of the avian cardiovascular system" compared with mammals. Several gaps are identified where "important evidence . . . still requires to be obtained" especially response to exercise. He examines cardiovascular control during rest, in diving, in flight, and with regard to environmental temperature.

Of the 3 purposes (gas exchange, temperature regulation, and vocalization), the first is emphasized by Knut Schmidt-Nielsen in "Recent advances in avian respiration." Body

size is seen to exert a major influence on rates of oxygen consumption. A brief section on anatomy is followed by "breathing and ventilation," again related to body size. The unique avian lung-air sac system is discussed lucidly in sections on gas flow and exchange, followed by oxygen carrying capacities of avian blood. The aerodynamic control of airflow remains an unsolved aspect of resting avian respiration; virtually nothing is known about gas flow during exercise and flight.

The next chapter, "Flight energetics," is by Vance Tucker, whose contributions in experimentation and theory establish him as a foremost ornithologist of our time. The level of intellectual effort required to cope with 21 equations and a half-page table of symbols is higher than for the descriptive prose of most ornithological works, but the great potential for understanding the physical basis of natural history patterns should be sufficient motivation.

"The theory" and Fig. 1 very lucidly set out the components of a bird's metabolic rate, so that anyone can visualize the power terms in equation 1. Equation 2 is reached on faith or via the derivations in the appendix to Tucker (1974). The assumptions involved are such that one cannot see at a glance where $P_{o_{in,\ par,\ pr}}$ went as components of eqn. 2 and what happened to $P_{i_{r,h}}$. Coefficients in eqn. 5 and 6 differ slightly from the same basal power relationship given on p. 35 of the previous chapter. Otherwise, the good logic is apparent and I could proceed intuitively, qualitatively to the reward. "Cost of transport," "Approximation equations," and "Energy budgets" bring us to the threshold of interpretation of migratory and time-allocation behavior. Tucker frankly acknowledges the limitations of the theory in applications to local activity vs. extended flight. This serves to remind us how over-simplified and tenuous are our "energy budgets." If the reduction of natural history to equations seems esthetically lacking, ponder how the bird "knows" or integrates information on profiles of winds aloft, or solves P_l/wV in order to pick the optimum altitude and effort. This is awe-inspiring!

In "Thermal homeostasis in birds," S. A. Richards points out that "few experiments have been designed specifically for the difficult task of separating the two possible components" of peripheral and central temperature receptors. Perhaps the temperature sensors should be in the deep-body, brain, and spinal regions, and heat-flux rather than temperature-sensors should be in the periphery. Richards describes emerging patterns, but carefully points out the limitations of methods and the interpretation of results. Central integration is not based solely upon hypothalamic input, but on a weighing such that the hypothalamus had 60 to 80% of the votes, at least in controlling panting. Especially interesting is the work on hypothalamic control of feather position index. The existence of non-shivering thermogenesis is neither disproven nor established.

"Renal and cloacal transport of salt and water," is, because of many recent reviews, limited by E. Skadhauge to recent observations. These include renal concentrating abilities of Western Australian birds' excretion of electrolytes, water, and nitrogen, cloacal resorption and interaction of renal and cloacal function, and the relationship between the concentrations of saline drinking water and renal concentrating ability. Skadhauge found an interesting correlation between weight-specific metabolic rate and maximum salinity of drinking fluid for water balance. A small bird such as the Zebra Finch can form a maximum urine concentration of 1000 mOsm, but fluids of about 1440 mOsm can constitute 10% of their water turnover, the difference being made up by metabolic water.

M. Peaker discusses "Recent advances in the physiology of the salt glands" as follows: "The primary stimulus" (increase in plasma tonicity, but not necessarily in osmolality), "Location of the receptors" (most likely "on or near the luminal wall of the major

blood vessels near the heart or the heart itself"), "The secretory reflex," and "secretion and blood flow." Salt glands are of interest not only in regard to homeostasis, but for the insight they can furnish regarding the basic functioning of cells and organs, the control of blood flow to secretory organs, and the coevolution of an organ and the mechanisms controlling the blood flow rates, which are the highest measured in any organ. From such flow the salt glands can remove up to 80% of the chloride, 57% of the sodium, and 21% of the water. The % increase in plasma sodium concentration needed to stimulate salt-gland secretion is inversely related to body mass.

In "Prolactin and adaptation," D. M. Ensor discusses the complex effects of environmental factors and blood composition on prolactin release and the effects of prolactin on nasal-gland function, food and water intake, fattening and fat utilization, water balance, and urine output.

Five chapters on reproductive physiology follow. R. K. Murton ("Ecological adaptation in avian reproductive physiology," pp. 151–152), Lofts ("Environmental control of reproduction," p. 189) and Follett and Davies ("Photoperiodicity and the neuroendocrine control of reproduction in birds," p. 207) agree that daily photoperiod serves (1) to entrain a circadian oscillation and (2) to induce the photoperiodic gonad-stimulating response when light falls within the photoinductible phase of that circadian rhythm. These are interesting accounts of ingenious attempts to understand the physiological clock and its linkage from long photoperiods outside to gonads' trophin secretion within. These papers must have provided stimulating exchange of current knowledge when presented originally. However, the editor could have produced a more effective review for those not attending by appointing 1 spokesman to integrate the information from 7 species and 3 chapters.

P. E. Lake reviews "Gamete production and the fertile period with particular reference to domesticated birds." The fertile period (prolonged survival of spermatozoa from insemination until fertilization or potential fertilization is said to have been "studied closely" and "to vary distinctly between species; the reasons for the inter-specific differences are not clear." He did not consider that duration of fertile period is a unit of physiological time, which may be strongly influenced or scaled to body size.

A symposium provides the opportunity for cross-fertilization of ideas and techniques. The influence of body size was noted in previous chapters. The potential for allometry in reproductive studies can be seen if one runs logarithmic regressions of fertile period as a function of body size in Lake's Table 1, p. 236. There are differences not only correlated with size but with order. Anseriformes have shorter spermatozoan fertile periods than Galliformes. Mean duration of galliform fertile periods $= 1.09\ m^{0.335}$ ($p < 0.001$), where m = body mass in g (representative body weights from other sources; original references which I was able to consult list no weights of sperm-donors or recipients). Considering the limited sample size, the exponent is roughly similar to those relating breath and heart cycle durations to body mass in birds. This relationship seems worthy of further examination.

Two chapters deal with the influence of hormones on nesting behavior, the authors reviewing their own experiments, using 2 species with long histories of adaptation to captivity and thus amenable to experimentation without undue alarm. In "The dual role of daylength in controlling canary reproduction," R. A. Hinde and E. Steel review their interesting experiments on the influence of photoperiod on nest-building in response to estrogen. This is followed by "The physiological basis of a behavior pattern in the domestic hen" by D. G. M. Wood-Gush and A. B. Gilbert. They established that the post-ovulatory follicle plays a major role in nesting behavior such as nest examination.

Injection of estrodiol benzonate and progestrone restores normal behavior after ovariectomy.

Having considered the control of reproduction and reproductive behavior, we proceed to the products, the nestlings and eggs. R. J. O'Conner reviews "Growth and metabolism in nestling passerines." A derivation from "Fourier's Law" of heat loss attempts to relate the development of homeothermy to "the decrease in surface-volume ratio and hence the reduction of the heat lost from each gram of heat producing tissue." The attempt goes awry when power functions of body weight are substituted for some but not all of the weight-dependent terms in the equation:

$$d\ Q_L/dt = W^{2/3}/r\ (T_B - T_A)$$

where $d\ Q_L/dt$ is rate of heat loss with time, W is nestling weight, r is specific insulation, and T_B and T_A are body and air temperature, respectively. However, it can be derived from Lasiewski et al. (Comp. Biochem. Physiol. 23:797–813, 1967) and Herreid and Kessel (Comp. Biochem. Physiol. 21:405–414, 1967) that the specific insulation (per unit surface area) is proportional to $W^{1/6}$. Thus, $d\ Q_L/dt$ is proportional to $W^{1/2}$ at T_A below thermoneutrality, as Kendeigh (Auk 86:13–25, 1969) has demonstrated empirically for adult birds.

Whether one includes the allometry of r and sees heat loss rate as a function of $W^{1/2}$ or uses $W^{1/3}$ as in the text, there is still a positive allometry of heat loss, *i.e.* the larger the nestling, the greater the total heat loss, and for that matter, the larger the nestling, the more surface area it has for heat loss. These facts invalidate the conclusion: "The simple change in surface-volume ratio inherent in a heavier body weight thus provides the simplest explanation of the observed pattern of metabolism in blue tits" (p. 301). Thus, increased metabolic-capacity, directly and through "Q_{10}-effect" as T_B is maintained higher, and increased insulation, must be the foundations for homeothermy. This dead-end digression should not distract the reader from the virtues of O'Conner's painstaking measurements and interesting data on growth in weight, plumage, and metabolism of the Blue Tit, House Martin, and House Sparrow.

We may take aspects of the natural history of birds, such as the formation of eggshells, for granted and never stop to wonder how they work. K. Simkiss reviews just how marvelously complex and incompletely understood are the calcium metabolism and regulation in "Calcium and avian reproduction," considering 8 current questions in the understanding of calcium metabolism. The subject is of interest not only in regard to this essential stage in perpetuation of birds, but as a system for basic cellular research. He concludes that "the control of avian calcium metabolism remains largely mysterious" but has pin-pointed research opportunity and provided new awe for egg-laying.

In "Pesticides and eggshell formation," A. S. Cooke contributes a valuable inquiry into eggshell thinning, comparing the effects of calcium-deficiency and sulfanilamide-treatment (chickens), DDT-treatment (ducks) and examination of shells collected beneath a heron rookery. Thinning seems to be caused both by reduction in availability of components and by normal deposition rates but premature termination. Cooke points out that these preliminary investigations must be followed up by detailed study of a single species, in both lab and field.

A symposium cannot produce a complete textbook on avian physiology but the ornithologist desiring a current knowledge of how the bird functions should have this volume. The physical quality of the volume is good, with flat glare-free paper. I found only 2 typographical errors. If more birders were sufficiently interested in the objects of their life-lists to make an informative work like this sell widely, perhaps the price could be less.—WILLIAM A. CALDER III.

AVIFAUNA OF NORTHWESTERN COLOMBIA, SOUTH AMERICA. By Jürgen Haffer. Bonner Zoologische Monographien, No. 7, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, 1975: 182 pp., paper, 7 plates, 51 text figs., 8 tables. Price 35 DM.—This would appear to be the latest installment by the author in a series of repetitively overlapping analyses of Pleistocene refugia and the subsequent dispersal of their avian populations. In the introductory portion he deals "with general aspects of the ecology and zoogeography of the avifauna of northwestern Colombia as they relate toward elucidating the relationships of this forest fauna with other trans-Andean faunas and with the Amazonian fauna." The second portion presents the results of his fieldwork from 1958 to 1967: "I summarize the information obtained and give a complete list of birds that I encountered. I specially emphasize the secondary contact zones of parapatric species and hybridizing subspecies. . . ." The format and contents quoted above differ little from that by the author in an earlier paper (Haffer, Am. Mus. Novitates, 1967, no. 2294:1–2).

The introductory portion has the greater significance as it synthesizes the secondary-contact itemizations which are scattered individually through the unevenly annotated list that is the second portion. On the positive side, the author clearly delineates his "core areas" and "suture zones." He names the endemic species in each of 8 distributional centers, amounting to a total of 195 in the forested lowlands of his entire trans-Andean "province." Any species that is not one of the 195 trans-Andean endemics the reader must assume to be cis-Andean as he is given no alternative.

On the negative side, the reader has no way of knowing which other birds—i.e. the great majority of the avifauna, including the bulk of the trans-Andean and most of the cis-Andean species—occur in or between any or all of the author's distributional centers. For one thing, the information is mostly not there. For another thing, the author's use of "trans-Andean" and "cis-Andean," "forest" and "nonforest," even "humid" and "dry" and "lowland" versus presumably cloud-forest highland, terms which must be understood in combination, can be confusing and contradictory.

Take, for example, the explanatory footnote on the opening page: "The tropical lowlands and their faunas west of the Andes and in Middle America are designated as 'trans-Andean' or 'Pacific', and those east of the Andes as 'cis-Andean' or 'Amazonian'." Only later does the reader realize that "trans-Andean" includes northern Colombia and Venezuela north of the Orinoco into Guyana, that "west of the Andes" may or may not include "north of the Andes," and that in Middle America, "Pacific" means primarily "Caribbean." He should keep in mind that a trans-Andean avifauna includes cis-Andean species; often it is not evident whether "trans-Andean" is intended in a restricted or in an unlimited sense.

A trans-Andean species, we learn, is at least specifically distant, while a cis-Andean species is either undifferentiated from or is at most subspecifically, distinct from a representative Amazonian population. This definition allows the cis-Andean element a short evolutionary life in which to remain what it is before transmuting into something trans-Andean. Nevertheless the cis-Andean element dominates the trans-Andean element by a ratio of from 1.3:1 to 2:1 (following the author's figures), while many trans-Andean endemics are not easily distinguishable at the specific level from cis-Andean representatives (p. 36). A paradoxical consequence is that in the cases of disagreement over the specific status of forms that are trans-Andean geographically, genetically they must be simultaneously trans-Andean to one authority and cis-Andean to the other. The author supplies no instance in which his 195 endemics may not have evolved from cis-Andean representatives.

Another consequence is that the reader is left to decide unaided the status of a contingent of Middle American species (e.g. *Trogon melanocephalus, Piculus simplex, Celeus castaneus, Piprites griseiceps*) belonging to South American genera that the author does not mention. By definition they cannot be cis-Andean, yet they are not listed among the trans-Andean. Similarly, the author does not include, for example, the Cathartidae, 2 members of which frequent forest, in a list of numbers of neotropical lowland forest birds (Table 3), perhaps because he tacitly considers them North American? The reader is ignorant not only of the specific composition of the trans-Andean avifauna in toto or per refugium but also of the species which the author for unstated reasons may or may not have included in his numerical totals.

This may be the place to quote his view, shared by many, that "the faunal relationships of the densely forested Caribbean slope of Panamá lie with the humid Pacific lowlands of northwestern South America," a peculiarity that is equally conspicuous in the case of the herpetofauna (p. 67). Unfortunately, the faunal resemblance formula the author chose to select (Table 6) shows western Panama to be much closer to Caribbean Costa Rica than to central and eastern Panama and as close to southeastern Mexico as to the Chocó lowlands on the Pacific side of Colombia. Central Panama and eastern Panama are both closer to the Cauca-Magdalena region at the drier northern end of the Andes than to the Chocó lowlands on the wetter Pacific side.

An illuminating comparison could perhaps have been attempted, whether by the reader or by the author, of the Chocó and the Caribbean Costa Rican centers. The author assigns them respective forest-bird totals of 247 and 239, with 112 trans-Andean species included in the former and 104 in the latter, while the number of cis-Andean species, 135, is the same in both. Only 58 of the trans-Andean species are held in common; no figure is given for the cis-Andean species. The opportunity to analyze the replacement of large numbers of presumed ecological counterparts on a virtual one-to-one basis has been lost simply because of the lack of species lists.

In regard to "forest" and "nonforest," the author includes as forest birds a number of species—e.g. *Laterallus albigularis, Jacana, Amazilia tzacatl, Synallaxis brachyura* and *S. erythrothorax, Geothlypis semiflava*—that I for one would not. Species the author lists here as forest birds he previously considered nonforest (Haffer, Hornero 10:315–333, 1967). Some examples are *Todirostrum sylvia, Thamnophilus doliatus, Galbula ruficauda, Basileuterus rivularis*. The trans-Andean *Ortalis garrula-cinereiceps* complex, used by the author to illustrate speciation in Amazonian forest birds (Haffer, Science 165 (3889), 1969), he now specifies as nonforest on p. 67 but includes in a table of forest birds in secondary contact on p. 58. The reader need not face these gratuitous conceptual difficulties as he cannot, in any event, reconstitute the avifaunas in Tables 2, 3, and 6.

As to "humid" and "dry," the author states (p. 30): "We are here concerned exclusively with an analysis of the avifauna of the trans-Andean humid lowland forests (Dry, Moist, Wet and Pluvial Forest in the Holdridge classification). . . ." Thus he sees fit to lump Holdridge's Dry Forest with Holdridge's humid to very wet forests, a largely unshared view. He does so, however, for the northern Colombian and western Venezuelan but not for the Middle American portions of his trans-Andean lowlands. Incidentally, the author uses the life-zone terminology and the numerical rainfall limits of Holdridge, yet Holdridge is not cited in the author's very long list of References.

Table 1 illustrates the author's interpretation of the ecological distribution of 131 selected species in northern Colombia in dry forest on the east, moist forest in the center, and wet forest in the west. This table and the accompanying text effectively mislead the

reader early in his excursion into "trans-Andea." The reader can hardly avoid the erroneous inference that the species which range throughout the Chocó wet forests, thence varying distances eastward into moist forest and sometimes into dry forest, are all Pacific or trans-Andean; the species that range primarily in dry forest and varying distances in moist forest, rarely reaching the Chocó wet forests, are all cis-Andean, though it may occur to him later in retrospect that a number may be "dry" trans-Andean, an apparent contradiction in terms the author's use of which makes it difficult to resolve.

Another result of his use of the Holdridge terminology without appreciating the concepts is that, whatever may be the author's idea of "lowland," it is not that of Holdridge, who defines it by biotemperature values which, except perhaps in local pockets, do not reach the lower limits of the atmospheric manifestation known as "cloud forest." A number of the author's tropical lowland species—e.g. *Bangsia arcaei*, *Popelairia conversii*, *Procnias carunculata*—are really subtropical inhabitants of his Caribbean Costa Rican distributional center (see Slud, Bull. Am. Mus. Nat. Hist. 128, 1964). Another species, *Euphonia anneae*, which is there subtropical, has also been found in the lowlands of eastern Panama. Thus the reader may wonder how the author may distribute other species which occur in the humid, sometimes in the "dry," lowlands in South America and only under very humid, mountainous conditions in Central America.

Finally, the wary reader should, among other items, take note that in Table 3 the heading "Caribbean Middle America" should be "Caribbean Costa Rica" and the use of "sympatric" for species known from areas the size of Surinam or southeastern Colombia is a misconception of the term; in Table 6, "southwestern Mexico" should be "southeastern Mexico," while "Guatemala" and the "Urabá region," included in Table 2, are omitted here; in Table 8, the 2 species of *Oncostoma* and 1 of the forms of *Geothlypis semiflava* are entered incorrectly.—PAUL SLUD.

THE BOOK OF BIRDS. FIVE CENTURIES OF BIRD ILLUSTRATION. By A. M. Lysaght. Phaidon Press, London, 1975: 208 pp., 142 illustrations (40 in color). $55.00.—A not infrequent dilemma for book reviewers in a specialized field such as ornithology, in which many of the authors are likely to be known personally to the reviewer, is whether or not to include "inside information" in a review, facts pertinent to some aspect of the publication that are not evident to other readers. This book is a case in point.

Averil Lysaght is a good friend, and I was privileged to examine an advance copy of her book at her home in London. I drew up for her benefit, at that time, a list of typographical errors, misidentifications, and other matters, so that nothing I may say in this review will come as a surprise to her. But I also had the benefit of a first-hand account of the problems she encountered in the course of getting out "The Book of Birds." The first thing that needs to be said is that the utterly banal title was imposed upon her by the publisher—the subtitle (which appears on the title page but not on the binding or the dust jacket) is a more precise indication of the subject matter. After the publisher was committed to this project, with advance contracts, a deadline, and half a dozen color blocks already made, the original author withdrew. Dr. Lysaght was persuaded to take on the job, with much encouragement and assistance from Derek Goodwin of the British Museum (Natural History) and Gavin Bridson of the Linnean Society (London). The pressure to meet deadlines was such that the publisher actually told the author that she need not see proofs after she had handed in the typescript!

In view of these and other items recounted to me about the history of this book, its beauty and the obvious care and scholarship evidenced in the text, are even more impressive. As the subtitle indicates, it is basically a survey of bird illustration, up to the late 19th Century. Ironically, the oldest painting reproduced, from a 12th Century Chinese scroll in the British Museum Department of Oriental Antiquities, a Finch-billed Bulbul (*Spizixos semitorques*) perched and singing among flowers, is one of the most meticulously accurate renditions in the book. Many of the best-selling bird artists of today have less understanding of the proportions, scalation, and mechanics of a bird's legs and feet than did the anonymous painter of this bulbul (possibly the Emperor Hui-tsung, 1082–1135).

The book opens with a 22-page introduction, a rapid survey of man's interest in birds from the most ancient times, gradually focusing on bird portrayal in particular. The emphasis at first is on birds in mythology and superstition, including the use of birds in ancient *materia medica*. There are such delightful tidbits as "Excrement of the cormorant mixed with lard was used [in ancient China] in the treatment of red noses resulting from too much wine." And how frustrating to be told only that "in Turkey, erotic cults concerned with geese are still extant"!

The text (introduction, notes to the plates, bibliography, index) is printed on a handsome dull-finished heavy gray paper, whereas the plates are on a white, faintly glossy stock. The margins are huge—the page measures 10½" by 14", but the type bed for the introduction is only 6" by 11½", printed toward the outer edge of the page. On the plate captions, the right margins are not justified. In a less expensive book, such design decisions might be considered extravagant, but the price of this book could scarcely have been significantly reduced had the 22 introductory pages been reduced by expansion of the type bed. And the visual effect is indeed striking.

The plates are arranged in rough chronological order, but with many exceptions, probably a concession to layout design and to the mixture of color and black-and-white printing. Reproduction of the color plates, printed in Holland, seems excellent. Each caption includes the English and scientific names of the bird or birds portrayed (if identifiable), bibliographic details of the original (if an unpublished work, the library or collection in which the original is housed), the medium and size of the original, and a variable miscellany about the artist, the author of the book in which a plate was first published, something about the bird, and various historical notes. Dr. Lysaght is not an ornithologist, but a specialist in the history of science, especially of the scientific and exploratory expeditions of the 18th and 19th centuries. This has meant that a few ornithological inaccuracies and misidentifications have slipped into the book, but for this small price we are rewarded with information and anecdotes from a field of scholarship virtually unknown to most modern ornithologists.

Identification of the rather crudely drawn birds in old woodcuts and engravings is sometimes almost impossible, and at other times uncertain. I believe "The Little Horn Owl" of plate 64 is probably a Scops Owl (*Otus scops*) rather than a Short-eared Owl (*Asio flammeus*) as identified in the caption, whereas the "Scops Owl" of plate 132 is definitely a Long-eared Owl (*Asio otus*). On plate 104, only figure 1 is a manakin of the genus *Chiroxiphia*; figure 2, which one might deduce from the text of the caption to be a female manakin, appears to me to be a White-headed Marsh-Tyrant (*Arundinicola leucocephala*). The text for plate 127 is a mixture of facts about the Imperial Woodpecker (*Campephilus imperialis*) and the portrayed Ivory-billed Woodpecker (*C. principalis*). Contrary to the statement accompanying plate 140, it is the New World and

not the Old World vultures that have a well developed olfactory sense. I found fewer than half a dozen typographical errors, and 3 or 4 obsolete scientific names.

Most of the expected ornithological artists are represented—Gould, Wolf, Audubon, Catesby, Bewick, etc.—and there are unexpectedly beautiful or charming portraits by lesser known or even anonymous artists. One's respect for 16th Century science is enhanced by a 1555 engraving by one Pierre Belon, homologizing the skeletons of man and bird. An odd color drawing by J. D. Meyer of Nuremburg (1713–1754) shows a pair of Blue Tits (*Parus caeruleus*) at the top of the plate and their skeletons, in the identical poses, at the bottom; the skeletons are done in far better detail than are the live birds. One could go on and on, listing the striking and the unexpected (the rather hackneyed Audubon Blue Jay, featured on the dust jacket, was not Dr. Lysaght's choice but was one of the few plates imposed on her by the publisher).

The somewhat overwhelming price of this book will unfortunately label it as a luxury item. Do not be misled by its oversize format and high price—it is emphatically *not* one of the virtually interchangeable and superfluous "coffee-table books" that have flooded the market in recent years (at least half having originated in England, which seems odd in view of the straitened British economy of the 1970's). Dr. Lysaght's book fills admirably an unoccupied niche in ornithological literature. Any reader with an interest in avian iconography might well begin dropping hints to any affluent relatives about a suitable birthday present.—KENNETH C. PARKES.

(N.B.—As of January 1977, this book appeared on at least one list of publisher's overstocks, at less than half the original list price. This is a bargain worth hunting for.)

IDENTIFICATION GUIDE TO EUROPEAN PASSERINES, 2nd (revised) edition. By Lars Svensson, illus. by the author. *Naturhistoriska Riksmuseet*, S 104 05 Stockholm 50, Sweden, 1975: 184 pp., ca. 160 line drawings. Price not given.—This compact (10 × 19 cm) identification guide by one of Europe's most noted ornithologists will be of use to a strictly limited number of people in the United States. It covers 180 species and 35 subspecies of European passerines and is primarily intended to present ageing and sexing characters for fledged birds in the hand. It is thus of little value for field ornithology but covers all the likely species a bird bander or museum worker might encounter.

The first 10 pages of "directions for use" and 15 pages of "general techniques for ageing and sexing" present a detailed explanation and discussion of the different methods used in the "systematic list" of species that follows. These introductory pages require careful reading if one is not familiar with the symbols and abbreviations used in the first edition of this book; however, all methods are fully explained and the practical problems discussed. The author follows the nomenclature of C. Vaurie, "*The Birds of the Palaearctic Fauna*," Passeriformes (1959), and he presents characters to identify the species (in difficult cases), the age, and the sex, where possible on external characters. There is also a summary of the molt regime, and wing lengths with sample sizes are usually given. Nearly every species description is accompanied by one or more text figures illustrating particular points of difference. A comprehensive 9 p. of important references are followed by an index of scientific names only.

Three controversial methods are perhaps worth singling out from an otherwise good presentation. Firstly, Svensson elects to number primary feathers ascendantly from wing tip towards the body, while most modern molt studies employ the descendant order, i.e. that in which the feathers are usually replaced. Secondly, he gives the impression that a live bird should be held with its head towards the bander's wrist during

measurements, whereas most North American and British banders prefer an alternate grip with the head held between the first 2 fingers and the body in the palm of the hand. Finally, the tail shape character used in ageing some birds, e.g. genus *Turdus*, may be even more difficult in practice than the author states. Apart from these, and a few minor errors, the overall impression is of an excellent specialist reference work embodying all the most recent information on ageing and sexing from a wide range of European sources. North American banders are doubtless eagerly awaiting a similarly complete and modern reference for nearctic passerines.—TREVOR L. LLOYD-EVANS.

STATE LAWS AS THEY PERTAIN TO SCIENTIFIC COLLECTING PERMITS. By M. Houston McGaugh and Hugh H. Genoways. Museology No. 2, 1976: 81 pp. Order from the Museum Shop, The Museum, Texas Tech University, Lubbock, TX 79409. $2.00—For each state as well as Puerto Rico and the Virgin Islands, the laws pertaining to collecting animals and plants are given, along with lists of protected species and game animals. The addresses of relevant state agencies are given so that one may write for further information or permit applications. These state laws are in addition to federal requirements, which the collector must also take into account when planning research.—R. J. R.

A GUIDE TO THE BIRDS OF PANAMA. By Robert S. Ridgely, illus. by John A. Gwynne, Jr. Princeton University Press, Princeton, N.J., 1976: xv + 394 pp., 32 color plates, many black-and-white drawings. $15.00.—Although smaller than the state of South Carolina, the Republic of Panama has a remarkably large avifauna of some 883 species, mainly because of its geographical location as an area of overlap between North and South American faunas. This book is a one-volume compendium of information useful both as a field guide and general reference. The author gives full credit and appreciation to Eugene Eisenmann, who encouraged him to write the book, and provided extensive field notes that Ridgely has incorporated into his text. Following a foreword by Alexander Wetmore and an introduction, there are chapters on Climate, Migration and Local Movements, Conservation, and on the Plan of the Book. The main text consists of species accounts organized by family. For each species there is a concise description, and sections on similar species, status and distribution, habits, and range. This is followed by an appendix listing and briefly describing additional species of southern Middle America that are not known to occur in Panama. A second appendix tells where to find birds in Panama, and includes such useful information as where it is safe to drink the water. The book ends with a bibliography and an index.

The color plates by Gwynne are conveniently grouped in the center of the book, and are a major contribution to the volume. The paintings are attractive, and the birds appear lifelike. These plates should be of great value in field identification, though it is obvious that some groups, such as the hummingbirds, woodcreepers, and flycatchers will pose special problems to the inexperienced observer because of the many similar species in each group.

Measuring about 16 × 23 cm the book is a bit large to carry easily in the field, yet from the amount of information included and the efficient, compact design of the book, it is clear that there is no wasted space. Students of tropical American ornithology will welcome this attractive addition to the literature of the area.—ROBERT J. RAIKOW.

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