

ORNITHOLOGICAL LITERATURE

AVIAN ENERGETICS. By Raymond A. Paynter, Jr. (ed.). Publications of the Nuttall Ornithological Club, No. 15, Cambridge, Mass. 1974: viii + 334 pp., 57 figs., 48 tables, 1 appendix. \$17.00. (Obtainable from the Nuttall Ornithological Club, c/o Museum of Comparative Zoology, Harvard Univ., Cambridge, MA 02138.)—Many ecologists are oriented toward understanding the complex environmental-organism interactions that underlie the adaptive properties of organisms. Recent reviews of the “strategies” with which organisms increase their inclusive fitness have explored how organisms might partition their time and energy in some “optimum” manner. A basic assumption is that constraints on time and energy expenditures are important determinants of the evolutionary success of a genotype. When measurement of benefits and costs is in the same units, energy or time, the potentially measurable selective forces acting on a single adaptive trait range effectively across all biologic attributes. For example, as Robert Ricklefs discusses in this volume, the question of growth rates of young birds is related to an interconnected series of factors such as food quality, foraging efficiency of the adults, predation pressure on both adults and young, the probability that the parents would do better by abandoning the present brood and trying to raise another brood later, the difficulty that the young face in finding food, and so on. These complex interactions at least theoretically become tractable when viewed in the units of the common currency, energy. The common thread through all these papers is that energetics is probably an important key to understanding ecological organization at whatever level of interest.

Fortunately for avian ecologists, comparative physiologists have refined the methods (and the actual estimates) of estimating energy expenditures of organisms. Most of this work has been principally in the laboratory and there is a growing awareness, expressed by the authors in this volume, of the need for additional refinements of the laboratory techniques for use in natural situations. The paper by James King provides a summary of available techniques of field estimates of energy expenditures and indicates their strengths and weaknesses.

As King emphasizes, the possible views that can be taken of the problem of field measurement of energy expenditures are as broad as the questions being asked by the field ecologist. Although the authors, principal discussants, and audience at the original symposium disagreed somewhat over the required detail of measurements, techniques are now available to ask questions of individual organisms in a microenvironment. William Calder's detailed analysis of the microenvironment of a nesting hummingbird verifies the importance of such a detailed approach to well-phrased questions. However, as Eugene Odum reiterates with his analogy between a microscope and a “macroscope,” not all questions about energetic expenditures can be approached fruitfully at this extremely detailed level; there is a necessary compromise between specificity and generality in any biological investigation. Calder has provided nearly the complete range with his discussion of the relationships among physiological and anatomical variables related to energetics and body weight of birds. His approach to the generality of certain adaptive traits in birds, presumably limited evolutionarily by energetic constraints, provides simple predictive equations, usually logarithmic, that relate each variable to body weight, independent of species. Calder emphasizes that his equations, which bring together a diverse literature, provide a starting point for understanding species which deviate from the expected relation. The use of these equations as initial hypotheses should spur work in many areas of avian energetics.

King also generates predictive equations for total energy budgets of birds on a seasonal and daily basis. More than general statements about what ought to be happening are difficult with so few seasonal data available, a clear signal to future ornithologists of an important area of research. King is on slightly firmer empirical ground with daily energy expenditures and provides comparisons among some birds and rodents. He ends with a discussion of the data that he thinks would provide a firmer empirical base for models of the interactions of organisms with their microenvironment and with each other.

Some problems inherent in the energetic approach to understanding ecological organization and adaptive strategies are brought out forcefully by Robert Ricklefs in his first rate review of the energetic requirements of reproduction. Ricklefs is not concerned with some major aspects of energy use in reproduction, such as the mating system, pair formation, nestbuilding, and other behavioral steps leading to the actual production and growth of the young. He rather discusses the costs of the production of functional reproductive organs and eggs, incubation, and growth of the young. At each step he provides clear summaries of much of the available literature and makes detailed comparisons between distinct adaptive types, e.g., growth rates of precocial and altricial young. His essay ends with an attempt to integrate energy expenditures into the complex of adaptations by which a genotype enhances its prospects of being represented in future generations.

Each of the first 3 authors draws on physiological measurements from the laboratory and field to estimate energy expenditures. Flight, the mode of energy expenditure nearly unique to birds among vertebrates, has also been one of the most difficult to measure. The last paper in this volume, by Vance Tucker, returns to the theme of coupling laboratory and field data in assessing energetic costs of free-living birds. His essay also illustrates the importance and frustration associated with the microview of energy expenditures—importance because his theoretical calculations and wind tunnel experiments have identified important variables in flight costs, and frustration because of the many variables that must be accurately measured in a free-living bird to precisely estimate flight costs. However, Tucker provides estimates of the impact of these variables on flight cost, leaving each investigator to decide if it is essential to measure particular variables. The advances made by Tucker and C. J. Pennycuik in England in the last few years in our understanding of flight energetics are a tribute to their perceptivity and ingenuity in treating a difficult problem. They have drawn heavily from aeronautical engineering theory and find remarkably close relations between theory and data. The importance of their work to an understanding of energetic organization of ecological systems will be obvious from the number of future citations of their work.

The rapidly expanding field of avian energetics depends heavily on the earlier work of avian physiologists and ecologists, 3 of whom were principal discussants at the symposium and whose comments have been printed in full (and expanded in the case of Charles Kendeigh) following each paper. The organizer of the symposium, William Dawson, is to be congratulated on his choice of participants. He also was responsible for the extremely helpful appendix of conversion constants for the international system of units used in avian energetics.

This volume is mostly concerned with only one half of the energy equation, the expenditure of energy. Although each author was cognizant of the problem, there is almost no discussion of energy intake, especially in free-living birds, principally due to a lack of field techniques for measuring energy intake. The intake half of the energy equation will have important ramifications on how energy and time are spent by an

organism, primarily through determining how much time and energy must be allotted to maintaining energy income, and thus effectively limiting the available time and energy for other expenditures. A further difficulty, mentioned by several contributors, is the lack of information on the role of nutrient intake in determining ecological organization. In this respect the plant ecologists are far ahead of animal ecologists. However, these deficiencies point out the relative infancy and bright future of the field of avian energetics.

The speed of development of this field speaks well for the foresight of the Nuttall Ornithological Club, sponsors of the symposium, in identifying a field of ornithological inquiry that would be an important, emerging field in the 1970's. The goal of the club to lead ornithology into the 70's rather than reminisce about the past is achieved admirably with the present volume. In an emerging field it is important that results of such a symposium appear in print as soon as possible. The editor is to be congratulated for limiting publication time to about one year following the symposium, and in a volume that is remarkably free of printing errors.

To modify slightly a statement by George Bartholomew, one of the discussants, this volume will be an essential reference for all workers in the field of avian energetics and will provide important summaries for the full spectrum of biologists.—LARRY L. WOLF.

THE LIFE OF BIRDS, 2 vols. By Jean Dorst. Translated by I. C. J. Galbraith. Columbia Univ. Press, N.Y., 1974: 718 pp., 110 text figs., 32 black-and-white photos. \$35.00.—Publication of these volumes, authored by a well-known ornithologist and produced by a prestigious press, is calculated to rouse anticipation. Even the price, although one to blanch at, would seem to indicate excellence. Intentions voiced in the Introduction set an interesting stage: to concentrate "on the adaptations birds have made to the various environments they have colonized" and to produce an "essay on the ecology of birds . . . not so much for the specialist as for the well-informed public."

Reviewers, by tradition, are concerned with how well the author has fulfilled his intention. Having finished 689 pages of text, however, this reviewer regards it inappropriate to address himself entirely to this charge. More pertinent, it appears, is an evaluation of the finished "product" the press has presented the public, a public, incidentally, which has come to expect outstanding publications in biology from Columbia's press.

It has been customary to employ proofreaders to eliminate mechanical errors in manuscript proofs. Is it possible that the bibliography after each chapter was not proofread? The first chapter of Volume 2 (Chapter 19) contains 4 references which are not in the bibliography. From the next chapter one reference has been omitted and, although "Davidson (1968)" is cited twice in Chapter 21, this reference was left out. No fewer than 5 references have been omitted from the bibliography of Chapter 23. Other chapters have suffered similar careless compilation of bibliographic citations. To "well-informed" readers a bibliography has some importance.

The proofreading—or lack of it—merits further comment. How is it possible that no one entrusted with the manuscript's proof discovered that Chapter 27 is followed by Chapter 29 and the latter by 28! A column of a table (p 142) is empty of any figures. The captions for plates 8 and 9 are apparently reversed. An ornithologist would have hastened to asterisk the Pelecanoididae (p 352) to signify that this taxon is also exclusively marine. And, couldn't *someone* have corrected "Anus" (p 514) to *Anas*! Such editorial *faux pas* well emphasize the careless handling this manuscript has had.

Having paid the price of these volumes, the buyer might well, on inspecting the

illustrations, wonder if in some way a dreary joke was not being perpetrated on him. Figure 2 looks as though it might have been inspired by works of Volcher Coiter or Pierre Belon. To me such text figures as Nos. 3, 4, 17, 18, 19, 27, 30, and 33 are largely meaningless. Many of them are indistinctly reproduced (e.g., 3 and 4) and many need labels (e.g., how can anyone interpret the lower drawing of Fig. 33?). Finally, what of the 32 black-and-white photographs which are, it would seem, intended as "dessert and coffee" of the text? Most of these are mediocre examples of the art of photography. Many are too dark (e.g., 10a, 31, 32), some are out of strict focus (10b, 15), some are confusing (17), and few have merit with respect to composition.

It is a pity that the French edition could not have been carefully translated. The English prose is not crisp, it is exasperatingly prolix, overwhelmingly dull, sometimes downright confusing, and altogether too often ungrammatical. I have selected some examples. "Although certain forest species do occupy the guinean [*sic*] savannas these do not include any whose ecological needs restrict them to the dense forest"—(p 508). "Quite possibly most Polynesian islands are too small to give rise to such evolution, which are known to be produced only under precise geographical conditions"—(p 559). "These incomparably aerial vertebrates have exploited this mobility to make themselves dominant in the highest layers of vegetation and all other niches which demand it to the full"—(p 576). "The principal characteristics of migration is its perfect regularity"—(p 616).

I suspect that many of the unusual terms and statements one stumbles over throughout the text are errors of translation and not those of Dorst. I cannot believe that Dorst would assign (p 69) herons and egrets along with ibises and spoonbills to the same family, Ardeidae. I find it difficult to credit him with such statements as the following. "Birds have adapted to all diets and feed on everything on earth"—(p 62). "Apart from a few raptors which hunt other birds, all carnivorous birds live on insects and on vertebrates of other classes"—(p. 576). ". . . birds have adopted every possible diet and are established in all available niches"—(p. 574). Repeatedly it is stated (e.g., p 589) that "birds are closely dependent on the environment." How many animals aren't? Can Dorst have depicted (Fig. 98) the breeding range of the American Robin so incompletely? Careful refereeing by an ornithologist would have eliminated these and many other inaccuracies.

In addressing myself to the subject matter of the text, I can but admit to disappointment at much of Volume I. The "well-informed public" might better turn to the several current texts of general ornithology for the information covered by this volume. These texts are written in a prose that is not awkward and they are not studded with inaccuracies. The reader should not be given such information as "there is no true muscle in these lower segments of the leg"—(referring on p 38 to the tarsometatarsus and the phalanges) or that (p 189) the many races of the Song Sparrow "are confined to the western coast of the United States."

In my opinion the 10 chapters of Volume 2 which deal with the avifauna of the major biomes of the world are the most useful part of the text. The discussions of deserts, tropical savannas, rainforests, etc. are interesting. It would have enhanced these chapters, however, if simple maps showing the extent of the biomes had been furnished. Pictures from these biomes would have added greatly to appreciation of them. What temperate zone resident, for example, can contemplate mangrove forests without some depiction of their morphology? Who is able to appreciate the distribution of these forests without a map?

"The touchstone of university press publishing continues to be high editorial merit, and no press has relaxed this standard in building its publishing program." So wrote the Executive Director of the American University Presses, Inc. in a letter to the *New York Times* (dated 17 April 1975). This letter was in response to comments by Alden Whitman (*New York Times*, 12 April 1975) regarding transformation of university presses into "profitable, best-seller ventures." Few would wish to deny university presses the advantages of "best-seller" books. But, in assuring themselves of such profit, presses may be tempted to economize to the extent of compromising careful refereeing, proof-reading, adequate translating, and good illustration. In my opinion this has occurred in production of the "Life of Birds." It is to be hoped—ferently—that these volumes will not mark further departure from the ways of careful editing of scholarly manuscripts, ways which have been established over such a long and productive period of publication by Columbia and other outstanding university presses.—OSCAR T. OWRE.

POPULATION ECOLOGY OF MIGRATORY BIRDS. Bureau of Sport Fisheries and Wildlife, Wildlife Research Report 2, Washington, D.C., 1972: x + 278 pp., paperbound; no price given.—This collection of 11 papers stems from a symposium held at the Migratory Bird Populations Station, U.S. Bureau of Sport Fisheries and Wildlife, in 1969 to celebrate the dedication of the Ira N. Gabrielson Laboratory. Publication of the papers was delayed until 1972, and the report was not distributed until late 1973. Unfortunately, relatively few copies were printed, for the volume was out-of-print shortly after the initial distribution.

The papers included in the volume address migratory bird populations in a variety of ways. Some (Williamson, Eberhart, Geis, Henny and Wight) are chiefly concerned with ways of analyzing banding and census data to reveal aspects of population dynamics, while others (Carrick, Drury and Nisbet, von Haartmann, Dzubin and Gollop, Boyd) provide detailed descriptions of populations. One paper reviews migratory pathways of waterfowl (Bellrose), and a concluding summary paper by Hickey reviews the major points and their implications.

The stated objective of the symposium is to review the current status of our knowledge of migratory bird population dynamics, with special reference to the use of banding data in such studies. If this collection of papers is representative, we apparently know just enough about avian population dynamics to realize that good generalizations (and good data) are hard to come by. Carrick's paper, for example, summarizes in considerable detail his long-term studies of Australian magpies, Royal Penguins, and Silver Gulls, and provides a wealth of individual life history information. But despite the almost unparalleled intensity of his studies, good information on mortality factors is largely lacking. The paper by Drury and Nisbet details the population movements of New England Herring Gulls, and like Carrick's studies, indicates that natural populations are disturbingly complex in their dynamics. Their attempt to provide adaptive arguments for the observed patterns is only moderately successful (although intriguing). The contributions of Boyd and of Dzubin and Gollop encounter similar difficulties in discerning crisp cause-effect relations in waterfowl population dynamics. Collectively, these studies suggest that intelligent management of migratory bird populations may be much more difficult than is commonly conveyed in wildlife curricula, and that much of the theoretical framework of armchair population ecologists may be of only limited applicability to real world situations.

Like most symposium collations, this one is spotty in quality and stimulation level. The 4 papers noted above provide a wealth of detailed information about specific populations.

Other contributions deal more explicitly with methods of population analysis, at times in a superficial manner. Overall, the contributions are characterized by a general lack of recourse to statistics (with the exception of Eberhart's model) or to population or evolutionary theory (with the exceptions of Drury and Nisbet and Dzubin and Gollop). Genetic factors influencing population dynamics receive only fleeting (and rather fumbled) consideration.

This volume thus provides a rather mixed sampling of descriptive studies of populations and their analysis, but contributes little to the theoretical framework of population biology. Given the 4 year publication lag, it is perhaps just as well that "facts" rather than theory (which changes rapidly) were emphasized.

A final word must be said about the publication itself. It is bad enough that the volume was printed in insufficient quantity to make it generally available, but if my copy is any indication, those copies which were printed will not last long. Mine fell to pieces before I was halfway through it.—JOHN A. WIENS

BREEDING BIOLOGY OF THE GRAY GULL, *LARUS MODESTUS*. By Thomas R. Howell, Braulio Araya, and William R. Millie. Univ. of California Publ. in Zoology, Vol. 104, Los Angeles, 1974: 54 pp, 21 plates, 7 figs.; paper cover. \$2.50.—This volume describes the breeding behavior and ecology of the Gray Gull, a species heretofore never studied on the breeding grounds. As such, it is a much needed and welcomed study. I feel it is a major contribution to our understanding of gull biology and behavior, and I recommend it to ornithologists strongly.

The Gray Gull is an abundant species on the Pacific coast of South America, and breeds in the barren deserts of the interior. The monograph covers courtship and mating behavior, clutch and egg size, incubation behavior, chick behavior, and mortality factors. Courtship behavior is described on the coast as well as inland. Incubation behavior includes incubation temperatures and the length of the incubation period. The sections dealing with chicks discuss nestling care, growth rates, food, and thermoregulation. Other sections include predation and other mortality factors on the young.

The methods section seems brief and does not explain how data were collected. The dates of the field work were unclear. For example, p 8 states that Howell was there from 30 November–9 December 1968, and p 9 states that he left 15 December.

Early sections of the monograph describe habitat, courtship displays, and colony size. The description of courtship behavior is clear, useful, and allows for a comparison with Moynihan's work (1962: Behav. Suppl. 8) on Gray Gull displays away from a breeding colony. As these are the only descriptions of Gray Gull displays on the breeding grounds, they are an important and invaluable addition to the gull literature. A limit on time, no doubt, prevented quantification of these displays. For example, the frequency of displays, the position of displaying birds, and sonograms of vocalizations are not given. I wonder how difficult it was to sex birds for behavioral descriptions without collecting birds or sexing them from copulation.

The section on size of colony and distribution of nests shows that nest distribution was random within their one 100 × 100 m study site. They mention, however, that nests were not uniformly distributed throughout the 5.5 km² colony area. No analysis of edge versus interior nests was made (cf. Coulson, Nature 1968: 478–479).

The point is made early that the behavior and ecology of the Gray Gull must be adapted to the harsh desert environment. Much of the monograph deals with its adaptations to this habitat. I wish the data were better quantified. They state that at dawn the ambient temperature is "only a few degrees above 0°" and by "mid-morning solar heat becomes

intense". In the "early afternoon" "strong" WSW winds begin, and "lower" the surface temperature (p 18). A partial graph of ambient temperature is given on p 20, but a complete 24 h graph would have been useful. They collected data on temperatures on the substrate in the sun and shade, inside 1 egg, and at the surface of 1 shaded egg. The temperatures of both experimental eggs reached lethal levels of 44° C. Thus, incubation must begin with the laying of the first egg to prevent death of the embryo.

The sections on incubation period, chicks, and nestling care contain much information on the reproductive biology of the Gray Gull, and are valuable for comparative purposes. Chick mortality resulted from exposure or starvation. Only chicks over 100 g in weight were able to thermoregulate in still air.

The discussion section includes ethology, advantages and disadvantages of desert nesting, taxonomic relationships, plumage color, and origin of desert nesting. The nature of the data lend themselves to a discussion of adaptations to desert nesting (present) and a comparison with other desert adaptations in birds (not present). They comment on the non-predatory behavior of Gray Gulls toward their own eggs and chicks, saying it is a derived condition (p 46). I see no reason to conclude this, as a good many of the "primitive" gulls do not prey on their own eggs and chicks.

The plates are excellent, clear, and lend much to the behavioral descriptions. My copy is clean and clear. In general I found the monograph to be readable and a major contribution to our understanding of gull biology. It covers the scope of the breeding cycle, and is thus very useful for comparison with other gulls. I recommend it for biologists interested in gulls, life histories, behavior, breeding biology, temperature regulation, and desert adaptations.—JOANNA BURGER.

WATERFOWL: THEIR BIOLOGY AND NATURAL HISTORY. By Paul A. Johnsgard. University of Nebraska Press, Lincoln, 1968: 138 pp., 89 black-and-white and 59 col. photographs, 16 figs. Introduction by Peter Scott. \$8.95.—In this single inexpensive text Johnsgard set out to provide nonprofessionals with a concise summary of the general biology of waterfowl and to provide photographs of all 142 living species of waterfowl of the world. Drawings of 4 species and 2 subspecies that are extinct are included. Laymen may be confused over some scientific and common names that Johnsgard uses. I agree with his use of scientific names even though they are not all recognized in the AOU Check-list. However in a text for nonprofessionals, the recognized names seem more appropriate.

Most photographs were taken by the author. Many color photos are excellent and provide good examples of adults in definitive alternate plumage (e.g. pl. 31, White-backed Duck and pl. 52, Comb Duck). As many as 13 of the black-and-white photos are of such poor quality that their use in the text is questionable (e.g. pl. 59, Cotton Pygmy Goose and pl. 83, Brown Pintail). This is unfortunate because Johnsgard is an accomplished photographer. Inclusion of the scientific name and range description near each photo would have been a valuable addition. Both are usually given in books for laymen.

Some of the figures are excellent. I especially like Fig. 1; however, laymen may not recognize these distinctive drawings of heads that represent the Tribes in the family Anatidae. In Fig. 3 restricted ranges might better be depicted by range maps rather than drawings of the species. In Chapter 4, Sound Production, syrinx variability (Fig. 5) is of interest to professionals, but I question the relevance of this figure for laymen. Nor are Figs. 6 (trachea of a Bewick's Swan) and 16 (Trumpeter Swan) of great enough importance to require an entire page.

The first 8 chapters provide information on distribution and migrations, ecology and general behavior, sound production, social behavior, breeding biology, molts and plumages,

and evolution and hybridization. In Chapter 9 Johnsgard discusses the scant information on extinct and near extinct species plus the taxonomic position of several perplexing species (e.g. Marbled Teal, Coscoroba Swan, White-backed Duck, and Freckled Duck). A discussion of endangered species is the primary theme in Chapter 10, Waterfowl, Man and the Future. Johnsgard might have been more emphatic about the decline of waterfowl numbers related to habitat loss because of human activities. This is a fact that all too few laymen realize.

My experience with students suggests that the use of the key in Chapter 11 would require drawings and possibly a good ornithological text or laboratory manual before the inexperienced person could use the key effectively. The annotated list of Anatidae in Chapter 12 is a helpful listing that is especially valuable to students.

I found the book inadequate for students taking a course in waterfowl biology and too filled with technical details for laymen. Even so, "Waterfowl" is a book that persons interested in waterfowl will want in their library. Considering the cost of other works on waterfowl of the world, \$8.95 is a bargain.—LEIGH H. FREDRICKSON.

THE AVIFAUNA OF THE KAKAMEGA FOREST, WESTERN KENYA, INCLUDING A BIRD POPULATION STUDY. By Dale A. Zimmerman. Bull. Am. Mus. Nat. Hist. 149 (3), 1972:255-340, 8 photographs, paper cover. \$3.40.—Kakamega forest is a unique island of relict semi-tropical rainforest, with many west African affinities in its flora and fauna unknown elsewhere in Kenya. Many naturalists believe that the forest and its wildlife should be completely protected, for they are endangered by man's activities. "With the present rate of forest destruction," writes Zimmerman, "we are likely to be denied the opportunity to learn."

Zimmerman's work is certainly the first census and population study of this forest, and probably the first population census of any forest in east Africa. He and Alec Forbes-Watson, of the National Museum, Nairobi, have produced a remarkable list of bird species. I was struck, however, by the absence of records of kingfishers in Kakamega. These birds are found in most large East African forests, so I wonder why they are absent here. I was also surprised by the statement that "some of van Someren's records (1922, Nov. Zoo. (Tring) 29:1-246) are difficult or impossible to locate specifically." This difficulty could have been overcome if Zimmerman had personally contacted van Someren in Nairobi.

The methods used to census a 20 acre block within the main forest included spot mapping by sight records, song, play-back recordings, collecting, mist-netting, and banding. The result is an important contribution to ornithology, particularly in East Africa, and a model on which censuses could be based in other East African forests.

Details about mist nets and their use should be heeded by banders. This method of capture can be disastrous in the hands of illegal operators, and nets have been stolen in Kakamega. Netting, however, made possible the recording and recovery of many species, particularly birds of the understory. These could easily have been missed on visual or sound assessment for, as noted, the songs of *Alethe* and *Sheppardia* were not learned or recorded, and these birds of the forest floor are readily overlooked.

Banding revealed an interesting survival rate, and Zimmerman's data, together with those of other workers netting the same area years later, are impressive. Some birds were recaptured after nearly 4 years in virtually the same spot. A *Cameroptera chloronota*, for example, was taken 5 times between June 1966, and December 1968. The data also demonstrate that there is little movement within a territory over a period

of years. Local Kenyan ornithologists, who freely provided Zimmerman with their records, are continuing to retrap birds that he banded. Recent recoveries, thanks to C. F. Mann of Kapsabet (unpublished), tell more about the life span of these birds and strengthen the belief that they do not wander far from their territories.

Zimmerman comments that in the Kakamega Forest, where the rainfall is 7.6 to 25.4 cm in every month of the year, there was no indication of breeding seasons. He was "surprised by the very few male birds which displayed truly large testes," and quotes Moreau et al. (1946, Proc. Zool. Soc. 117 (2 & 3):345-364) to the effect that "Spermatogenesis commonly takes place in testes that have not attained full size." What is the size of non-active testes, and how much do they enlarge? Measurements are often given to indicate enlargement, but they are meaningless unless the size of the dormant testes is known and quoted for each species.

Flocks of mixed species in the treetops visited the census area but proved difficult to enumerate. Zimmerman simply identified and counted them. *Parus funereus* was a frequent nucleus species, present in 80% or more of the Kakamega parties. Interestingly, Start (1971, Hons. thesis, Univ. of Aberdeen) found *P. albiventris* to be the nucleus species in bird parties in the Karen Forest, near Nairobi, Kenya.

Zimmerman comments on the apparent rarity of bird/ant associations at Kakamega as compared with his observations in Central American forests. In my experience, columns of doryline ants are inconspicuous, but when these ants are spread out and raiding, birds appear in numbers and are always at the front of the raid to capture aroused insects. Evidently Zimmerman did not meet with such raiding parties.

The total number of adult birds in the census area was remarkably uniform in the 3 periods of Zimmerman's study, although the composition and numbers of species varied. The population in 1966 was nearly 25 birds per acre, but we cannot say whether this was high, low, or normal for a forest area until comparable counting is done in other forest regions in East Africa. We really have no knowledge of the carrying capacity of our forests, although this reviewer's 10-acre block of indigenous trees near Nairobi supports 9 breeding residents and 19 transients per acre.

The Kakamega Forest population is indeed impressive, considering the limited period of the observations over 3 visits. Zimmerman comments that an area should be "studied through at least one full year before a true picture of the population can be obtained." His results nevertheless form an excellent basis for future studies. How right is his remark that "even a 500 acre block may represent the minimum area capable of supporting a reasonably natural bird population. Additional study may show this figure to be far too low. Certainly an area so restricted could not maintain itself as a truly natural forest environment indefinitely."

We in East Africa today have no idea what our bird population is, in forest or elsewhere, and little attempt has been made to obtain population statistics on which to base sound conservation measures. Zimmerman's study should be an incentive for others to carry out like studies in all our diverse environments. I am alarmed by the present policy, whereby much indigenous forest is being cut out and replaced by exotic plantations. This affects the whole ecology of an area, and the loss of fauna, flora, and insect life could be devastating and irreplaceable.

I appreciate Zimmerman's use of the older nomenclature, which generally follows Mackworth-Praed and Grant (1955, Birds of Eastern and North Eastern Africa. African Handbook of Birds, Ser. I, Vol. 2, Longmans, Green and Co., Ltd., London.; 1960, same, 2nd ed.). For example, he maintains *Platysteria* and *Diaphorophia* which

are very different in the field. Also, *Phormoplectes* and *Simplectes* are not lumped under *Ploceus*.

The annotated list of species provides much useful information, but unfortunately some of the fruits, seeds, and flowering plants on which birds were feeding are not mentioned specifically, and data on crop contents are not provided. An interesting analysis could have been made of various bird groups' major food requirements. This could give some indication of the zones exploited from the ground level to treetop.

Zimmerman's comparison of the Kakamega avifauna with that of other forests is striking, as it shows that the Kakamega-Nandi avifauna is one of the richest yet reported for East Africa. Moreau (1966, the Bird Faunas of Africa and its Islands, Academic Press, London) did not include Kakamega in his review.

The report discusses bird habitats, but until more detailed analysis is made, the reasons for associating particular birds with one type of forest remain in doubt. Forests may be similar in number of species of trees and shrubs, but the canopy cover, density, and diversity of understory growth also determine what habitat suits bird species, and this effects the ecology, particularly for the exploitation of food resources.

Zimmerman's study shows that many more coordinated assessments are needed in order to understand all the factors that affect bird populations, and hence the differences in the avifaunas of different forests. This will require time and money to achieve. One reason for our paucity of ornithological knowledge in East Africa is that virtually all studies in the past 70 years or more was done by amateurs, in their spare time and at their own expense. They have made no mean contribution under the circumstances. Full-time ornithological investigations are needed before it is too late, and Zimmerman's excellent contribution is a more than useful basis for future workers to build upon.—G. R. CUNNINGHAM-VAN SOMEREN.

FEEDING ECOLOGY OF PINTAIL, GADWALL, AMERICAN WIDGEON AND LESSER SCAUP DUCKLINGS. By Lawson G. Sugden. Canadian Wildlife Service Report Series No. 24, 1973: 45 pp. \$1.50.

HOME RANGE AND BREEDING BIOLOGY OF THE SHOVELER. By H. J. Poston. Canadian Wildlife Service Report Series No. 25, 1974: 49 pp. \$1.50.

BIRD DAMAGE TO FRUIT CROPS IN THE NIAGARA PENINSULA. By R. G. B. Brown. Canadian Wildlife Service Report Series No. 27, 1974: 57 pp. \$1.50.

MIGRATION OF LESSER SNOW AND BLUE GEESE, PART 1. By H. Blokpoel. Canadian Wildlife Service Report Series No. 28, 1974: 30 pp. \$1.00.

MIGRATION OF LESSER SNOW AND BLUE GEESE, PART 2. By H. Blokpoel and Maureen C. Gauthier. Canadian Wildlife Service Report Series No. 32, 1975: 30 pp. \$1.00 (Canada), \$1.20 (other countries).

These attractively printed, paper-covered reports contain extensive data summarized in tables, charts, and graphs along with the text. Available by mail from Information Canada, Ottawa K1A 0S9, Canada.—R.J.R.