REVIEWS

The organization and probable evolution of some mixed species flocks of Neotropical birds.—M. Moynihan. *Smithsonian Miscellaneous Collections*, vol. 143, no. 7. Pp. 1–140, 1962. $1.50.—This important paper, based upon three years' study in Panama, should be considered in conjunction with the author's earlier study of adaptations that promote interspecific gregariousness (*Proc. XIIth Internat. Ornith. Congr.*, pp. 523–541, 1960). Major contributions are the attempt to quantify observations in terms of associations of species, non-hostile joining or following reactions, supplanting attacks, etc., and the interpretation of the findings in behavioral terms. Data presented as examples collected during a two-month interval occupy 44 tables.

Moynihan's principal effort was directed to the study of a grouping occupying lowland forest edge (the blue and green tanager and honeycreeper "alliance"), with extensive comparisons with montane flocks, and with other groupings incidentally. As a consequence of these studies he extended the terminology of Winterbottom and D. E. Davis, characterizing the social roles of members of mixed species flocks in the following four categories: nuclear (stimulating formation or maintaining cohesion) versus attendant, and regular (approaching or being approached often) versus occasional. Nuclear species were subdivided into active (those that follow or join individuals of other species more frequently than they are joined or followed) and passive. Species of the latter category usually exhibit pronounced intraspecific gregariousness, and attract individuals of other species by their conspicuousness of manner and voice, and probably by their numbers as well. The author demonstrates positive "special interspecific preferences" (in contrast to "generalized gregariousness"), and throughout the account one gains the impression of characteristic and rather constant interspecific reactions recurring under similar conditions.

Mixed species flocks are judged to have evolved through development of preferences for "attractive" species. The primary advantage subserving the flocking in the Panamanian lowland group is thought to be the enhanced detection of predators. Such flocks appear more prevalent in peripheral parts of the New World tropics than in the Amazon Basin, leading to the suggestion that the flocking habit is more strongly developed in habitats that are less favorable or partially isolated. This pattern appears to parallel the increase in cohesiveness in temperate-latitude flocks with the onset of unfavorable weather.

The author exercises caution in his generalizations, but the hypothesis that general body coloration may have been altered in response to *interspecific* social pressures prompts one to seek alternate interpretations. The neutral (gray) coloration of a passive nuclear species of tanager, *Tangara inornata*, is postulated (p. 44) as representing a compromise that renders individuals conspicuous in a green environment yet "acceptable" to a variety of brightly colored neighbor species. Convergence is suggested as an explanation for the similarity in the brownish plumage of the bush-tanager, *Chlorospingus ophthalmicus*, and a warbler, *Basileuterus melanogenys*, this similarity serving (p. 86) to facilitate the formation of montane flocks. However, in the relatively stable tropical environment the interactions among sedentary species of narrowly restricted habitat occurrence are in force throughout the year, and may allow selective forces to act in ways or to extents that would not be possible under the fluctuating conditions of temperate latitudes.

This paper provides a sound basis for comparative studies at least in structurally simpler timbered areas where mixed species flocks are found.—Keith L. Dixon.

Structural adaptations of the head and neck in the Black Skimmer, *Rynchops nigra* Linnaeus.—Richard L. Zusi. Publs. Nuttall Ornith. Club, no. 3, pp. i–viii, 1–101, figs. 1–44. Nuttall Ornithological Club (c/o Museum of Comparative Zoology, Harvard University), Cambridge 38, Massachusetts, 1962. Cloth $3.00 postpaid.—This book is recommended as an important contribution to the literature concerned with functional anatomy of birds and vertebrates. It is written in the spirit of functional anatomy, correlating a detailed analysis of the peculiar method of feeding in the Black Skimmer with the anatomical substrate of the head and neck which subserves that behavior. In order to emphasize structural modifications from a fundamental pattern and the possible relationship of these modifications to feeding behavior, the Black Skimmer is compared with three other members of the subfamily Sterninae that represent opposite extremes in a continuum of feeding behaviors from divers to non-divers; the Royal Tern (*Thalasseus maximus*), Gull-billed Tern (*Gelochelidon nilotica*), and Laughing Gull (*Larus atricilla*). Based largely upon field observations and slow motion movies by Zusi, the feeding behavior of the Black Skimmer and the other three species is intensively scrutinized. Line drawings taken from motion picture frames illustrate particularly well the several significant points made concerning the skimming posture and the movements of head and neck when submerged objects are encountered or fish are caught.

In the discussion of structural adaptations of the Black Skimmer's bill, Zusi points out that the great variation in length of the lower jaw probably is caused largely by abrasion and breakage. A well-conceived suggestion is advanced that the depth of submergence of the bill during skimming may be assessed by the bird, owing to varying degrees of vibration caused by water passing over the rhamphothecal ridges. (It would have been helpful to the non-specialist reader had certain structures such as rhamphotheca and tomium been defined in the text or labelled in the figures.) Analysis of the structural adaptations of the skull and jaws is thorough. Environmental forces acting upon the head during skimming and catching prey are evaluated, and, where appropriate, these forces are discussed in relationship to the proportional size of individual bones of the skull and to modifications in the structure of the lower jaw, upper jaw, and palate. The jaw musculature of the Royal Tern is described in detail and the Black Skimmer, Gull-billed Tern, and Laughing Gull mentioned only in so far as they differ from the Royal Tern. The muscles are well described and the treatment given the aponeuroses associated with the morphology of individual muscles is laudable. The action of each muscle is assessed within the limits of the particular methods employed in this study. Little difference in basic pattern of the jaw muscles is found among the four species examined. Most jaw muscles of the Black Skimmer appear to be relatively larger and more powerfully constructed, or appear to have a greater mechanical advantage, than those of the other gulls and terns studied. Zusi concludes that adaptations for skimming have been achieved with only moderate changes in the characteristic jaw muscle pattern. One can not help but speculate upon the possibilities for extending Zusi's findings by utilizing a more quantitative approach in the functional evaluation of the jaw muscles.

The section on anatomy and function of the neck is quite well handled. This region of the body is perhaps one of the most difficult to assess, and Zusi has done an admirable piece of work. Although the fundamental structural plan of the cervical vertebrae and neck musculature in all four species studied is similar, certain differences between the neck muscles of the Black Skimmer and the other species examined appear to represent adaptations related to feeding behavior.—Donald C. Goodman.

A bird and its bush.—Michael Lister. Phoenix House Ltd., London, 1962. 142 pp., 16 pls. (photos.) and 16 line illustrations. Price, 16s.—In the author's words, "this book is a sketch (in charcoal, giving soft and maybe blurred outlines, for the subject does not lend itself to sharp definitions) of some of the aspects of a bird's relationship to the countryside in which it lives, and to the other creatures which live there too." A first chapter, "Distribution and Habitats," includes a terse account of the world's major biogeographic regions as well as brief mention of ecology, including ecological factors. Following this are major sections concerning (1) geology, soils, and topography; (2) climate and weather (this part, well-illustrated, is notable for its succinct definitions); and (3) vegetation, this last treating of subjects such as plant successions, seasonal changes, and birds and plants. A fifth chapter, "Types of British Vegetation," will, if used in conjunction with lists of habitat types given in the Appendix, enable observers "to identify correctly the particular habitat with which they are concerned."

The helpful illustrations all pertain not to "a bird" but to "its bush." Line drawings depict salient or diagnostic features of nearly 40 species of British plants. Most of the plates (including 35 photographs) show different habitat types, although several refer to the chapter on meteorological phenomena and illustrate various sorts of clouds.

"Birds and Their Neighbours" are taken up in the next two chapters—the first dealing with ecological relations among birds, the second with birds and other animals, including man. In a section on mixed bird parties (p. 86 ff.) as well as elsewhere, the author draws on his personal field experiences, including experiences in the Indo-Himalayan region. In addition, he makes skillful use of pertinent literature. Bird students who are concerned with the classification and quantitative appraisal of vegetation and related habitat characteristics (such as soil types) ought to find the final chapter, "Habitat Surveys," of considerable interest and use. Not infrequently the author points to areas that invite further research (e.g.: "The larger elements in a food chain are not difficult to see, but an enormous amount still remains to be learned about the particular foods, both qualitatively and quantitatively, especially at the lower levels of the chain."). And there is a good deal of specific advice for neophytes in the field (e.g.: "it must be emphasized that there cannot be too much detail in your notes. It is difficult to know at the beginning of a survey just what features are going to be important and what are not . . . .").

In the way of criticism I have little to offer. Although the author does mention fire, especially in connection with dry-season bush fires in Nyasaland, he does not consider it a climatic factor or relate it to lightning. Nor is lightning mentioned in the section on "weather ingredients and phenomena" or elsewhere in the text. Typographical or pen-slip errors are very few; perhaps the only serious one appears in the short definition of Bergmann's rule (p. 22), thus: "Within a polytypic, warm-blooded species the body size of a subspecies usually increases with increasing [should be *decreasing*] mean temperature of the habitat . . . ." Some readers might adopt an attitude of "counter-provinciality" and claim that the author slighted New World or non-British literature, but it is my feeling that such a reaction would be unjustified, for it is patent that the book *as a whole* is designed primarily for, and will be of greatest value to, the field biologist in the British Isles.

The Appendix, prepared by W. B. Yapp and entitled "Classification of the Habitats of British Birds," would seem to be useful not only to workers in Britain but also to others (especially if used in conjunction with J. T. Emlen's method for describing and comparing habitats) who wish to compare "pertinent physiognomic features" of

British vegetation with those of other regions. In addition to a valuable, 254-title bibliography, there is an adequate general index and an index containing scientific names of birds and plants mentioned in the text. The book's refreshingly modest title scarcely suggests its scope, compactness, and richness of content. Any collection of sound, fact-filled volumes that the ecological ornithologist would find useful would be enhanced by the addition of *A bird and its bush*. In such company, this bedfellow would be neither strange nor unsubstantial.—ROBERT A. NORRIS.

The hawking of Japan The history and development of Japanese falconry.—E[verett]. W[illiam]. Jameson, Jr. Davis, California, published by the author, 1962. Pp. [I]–[XIV], 1–97, col. frontisp., col. pls. I–V, photogr. pls. 1–5, figs. 1–19, decor. chapter headings. 10¼ × 7 in. $15.00.—Of all sports practiced by mankind none—save possibly angling for trout—has a literature as copious, as laden with a curious mixture of scientific fact and mysticism, and as closely allied with natural history as falconry. Despite the indirect contributions of trout fishermen (and -women), from Dame Juliana Berners and Isaak Walton on, to our knowledge of fish ecology and psychology, not to mention the natural history of the Ephemeridae, falconry perhaps may lay claim to being closest in its alliance with the natural sciences, since, in all the early history of these, few works loom larger than the Emperor Frederick II's *De arte venandi cum avibus* of *ca.* 1250 A. D.

While many charlatans and plagiarists have written on the lore of hunting with hawks, there have also (since the Emperor) been various contributors from the ranks of responsible zoologists, for example Schlegel and Wolverhorst, James Edmund Harting, F. H. Salvin and W. Brodrick, and Casey A. Wood. Such an author is E. W. Jameson, Jr., mammalogist-ecologist turned acarologist, and a dedicated falconer since this reviewer, when a freshman, first saw him in 1940 as a Cornell University sophomore carrying a somewhat unpredictable Cooper's Hawk. Time spent in Japan, and the aid resulting from a fortunate marriage to a gifted translator and collaborator, have provided Dr. Jameson with rarely paralleled opportunities to observe Nipponese falconry and examine its historical documents.

Falconry having originated in the Orient, it is paradoxical that the great works of that area remain almost wholly untranslated (a useful list of them is provided in this book). In the present, small, but informative and sensitively illustrated work the author provides for western falconers virtually the first really authoritative insight into the methods and traditions of their Japanese counterparts, traditions as delicately precise, as different, and as Oriental, as Japanese paintings and architecture. For ornithologists and behaviorists, there are illuminating glimpses of the psychology and characteristics of the Goshawk (*Accipiter gentilis fujiyamae, A. g. schvedowi,* and *A. g. albidus*), of the Eurasian (*A. nisus*) and Besra (*A. virgatus*) sparrowhawks—the former, contrary to popular western opinion, differs radically from the North American Sharp-shinned Hawk (*A. striatus*), which is much more closely resembled by the latter—and of that powerful and (to most of us) little known predator the Japanese Hawk-eagle (*Spizaetus nipalensis orientalis*).

Beautifully made, the book will grace any shelf. The title, perhaps, is more accurate than the subtitle, which suggests something a little more definitive. Occasional lapses from clarity, by Occidental notions, may owe to excessive faithfulness in preserving the Oriental spirit of the original sources interviewed, translated, or examined. —ROBERT M. MENGEL.

The migrations of birds.—Jean Dorst. Boston, Houghton Mifflin Co., 1962. Pp. i–xix, 1–476, figs. 1–129, 8½ × 5½ in. $6.75. (Published also by Heinemann, London.)—In his delightful foreword, Roger Tory Peterson points out that thousands of interesting facts fill this book of a distinguished scholar and ornithologist. The author, Curator of the Division of Mammals and Birds at the National Museum of Natural History in Paris, unpretentiously sums up his notable presentation by remarking that our current knowledge of the phenomenon of bird migration still amounts to only a few guideposts planted in an almost virgin forest. This new edition of his earlier French publication, translated by Constance D. Sherman, is revised and brought up to date.

Jean Dorst knows the worldwide literature on the topic thoroughly and selects from it with the viewpoint of a true ornithologist the pertinent facts, data, interpretations, and theories. He covers the phenomena of bird migrations as they occur the world over on every continent and ocean. He writes brilliantly and with an amiable Gallic charm from which we can accept an occasional emotional anthropomorphism such as of birds fighting "jealously"; but I think one should not write that birds "migrate to avoid winter." From the factual viewpoint his writing is objective and well-weighed, and his sound definitions of migration terms should become generally accepted by all ornithologists. Migration, though evolved from non-cyclical or one-way movements, he reserves for cyclic or periodic movements. Other types he defines include emigration, immigration, invasion, extension, and dispersal. The author suggests the term "rest area" where it is more adequate than "winter quarters," correlating it with the period of sexual inactivity (not "inactive sexual period," p. xiv).

The short introductory survey of migratory phenomena throughout the animal kingdom impresses on the reader the enormous diversity of migratory behavior in other animals as well as among birds, where it is so highly exemplified. While birds and their migrations have attracted the attention of man ever since ancient times, his understanding of the periodic appearance and disappearance of birds was long obscured by mystic and religious veils. Only gradually were those early advocates of the theory of migration believed, and we may assume that the observations and the writings of such a famous early "migrationist" as Pierre Belon were forgotten when in the eighteenth century the revolution of scientific thinking began.

From his stimulating historical review, Dorst leads to the methods of studying bird migrations. He starts out with the all-important field observation including the modern sophisticated methods of Graber's acoustic and Lowery's moon observation and the very promising radar control. He makes full use of the data from banding activities all over the world. He lists the major banding efforts, headed by the U. S. A. with a total of some 11,000,000 bandings with some 600,000 new additions every year, including about 900,000 recoveries and some 50,000 yearly additions of recovered banded birds.

In classifying the diverse migration phenomena, Dorst groups his examples quite significantly according to ecological or taxonomical bases. He talks about pathways and goals of coastal birds, swallows and swifts, ducks, starlings, and others. He makes the reader familiar with the principal migratory routes in the Old World and the various important analyses of European ornithologists. His statement that there are more species wintering in east than in west Africa, because of the supplementary influx of birds from eastern Europe and Siberia, makes me wonder if this is indeed so. There are enough migrants known that cross Africa from the northeast to the southwest. Thorough investigation of banded migrants remains still a challenge for ornithologists all over Africa.

The author turns next to migrations in North America. He points out differences from those found in Europe. There are no geographical barriers between the temperate and tropical region like the Mediterranean and the Sahara, no east–west ramparts like the Alps, and the North American continent itself encompasses a huge area suitable for wintering. Dorst mentions the tropical origin of a large proportion of the Nearctic birds as the reason for their cyclic flights, and he describes the over-all problem of migration in North America referring to the migration patterns of a number of species. Shorebirds, pigeons, cuckoos, hummingbirds, flycatchers, and further important groups of migrants are used to evaluate the complicated system of migratory flyways from the Atlantic to the Pacific. He points out that there is nothing rigorously exact about these flyways, and with his examples he calls to attention the necessity of further detailed investigations at the specific and even subspecific level. In too many cases we still have to rely on Lincoln's historic plottings of pathways and wintering zones which challenge ornithologists to apply modern research techniques, the result of recent field studies, and new accumulations of bandings to complete the picture of migration.

The author calls to our attention seasonal flights in the southern hemisphere. Few, but fascinating intertropical migrations make us aware of the effectiveness of direct environmental stimuli. The discussion reaches a peak with examples of spectacular seabird migrations, the notable oceanic flights of the jaegers, the nomadic wanderings of the skuas, and the most fascinating flights of the Arctic Terns and other long-distance travelers. It is pleasant to note that Dorst had not the habit of compiling other compilations; he rather profoundly studied and listed the contributions of the original investigators. He points to correlations between transoceanic flights and prevailing winds, as in the case of the Short-tailed Shearwater or the Wilson's Petrel; and he marks our lack of knowledge about releasing and directing stimuli in other cases of migrations over the seas. Penguins are mentioned migrating by swimming, and the author briefly refers to the Emperor Penguin's reversed annual cycle and migration pattern as compared to those of other austral penguins. We may add that some of them also migrate by walking, and their cyclic goal-directed migrations also include those appearing during the reproductive cycle. Land birds as "hitch-hikers" across the ocean on board ships, swept by wind, or actively migrating across the great waters are further mentioned in this chapter.

In Modes of Migration the author writes about narrow and wide migration routes, multiple airways, primary and secondary routes, ecological attractions and repulsions, and influences of weather conditions on migrations. Migratory behavior patterns are analyzed as to period and duration of migratory flights, and various sociabilities of migrants, flock formation, diurnal and nocturnal migrations, and migratory peaks are all discussed.

Avian mass movements, controlled by external and/or internal factors, lacking the regularity of cyclic migration, are described under Bird Invasions for a number of species. Little is analyzed here by ornithologists, and for interpreting guesses we still depend much on results from analyses of invasions and population dynamics in mammals.

With a short discussion of possible hibernation found in some species of birds, Dorst leads over to the study of physiological stimuli of migration. He carefully discriminates between endogenous and exogenous components determining or influencing the annual cycle, writes about connections between migration and molt and sexual cycle, and partial migration based on physiological variations in one and the same species, population, and, we may add, even individual. He thoroughly covers Rowan's

early pioneer experiments as well as recent investigations on the influences of temperature, light, thyroid and pituitary activity, etc. He wisely points to the possibility of an infinite number of special cases and an even greater variability of their determinants.

In Orientation of Migratory Birds the author lists the various methods of approach and the results they have yielded. He refers to Griffin's concept of different types of homing, reviews the explanations involving unknown senses, and subsequently winds up with orientation based on known senses and referring to familiar topographical features (primarily of ecological importance) and to astronomical landmarks. Dorst leads the reader through the late Gustav Kramer's famous pioneer studies and his findings on sun-compass orientation, Hoffmann's investigations of the starling's internal clock, Matthews's sun-navigation theory, and the findings of the Sauers on the star orientation of nocturnal migrants. He writes about enormous advancements but does not forget to remind us that we still know practically nothing about the psychophysiological processes that enable the birds to get their bearings from the all-important celestial bodies.

With a thoughtful approach to the question on the origin and evolution of bird migration, whose answer "must remain in the realm of pure conjecture," Dorst concludes and sums up his treatise. He has revealed a single part of avian life in the framework of ecology, the science of our century, a part as complex and diverse as the whole class of the birds itself is. It reminds us to be on guard against oversimplified explanations. In itself the book is a guidepost for future research, a magnificent scholarly work. It is fairly well illustrated with maps to which the publisher could have added a well labelled map of the world on the end sheets just for the numerous younger ornithologists who have not yet acquired enough geographical knowledge and experience of the globe spanned by the migrants. Nevertheless, young and old ornithologists will immensely profit from this book that objectively reviews a fascinating history of ornithology and its channelling into recent advancements that characterize ornithology as highly contributive to the modern advancements of the biological sciences.—E. G. Franz Sauer.

White, C. M. N. 1960. **A check list of the Ethiopian Muscicapidae (Sylviinae). Part I.** Occ. Pap. Nat. Mus. So. Rhodesia, **24B:** 399–430. 1961. **A revised check list of African broadbills, pittas, larks, swallows, wagtails and pipits.** Govt. Printer, Lusaka, Northern Rhodesia, 5/–. 1962. **A revised check list of African shrikes, orioles, drongos, starlings, crows, waxwings, cuckoo-shrikes, bulbuls, accentors, thrushes and babblers.** Govt. Printer, Lusaka, Northern Rhodesia, 7/6. 1962. **A check list of the Ethiopian Muscicapidae (Sylviinae). Parts II and III.** Occ. Pap. Nat. Mus. So. Rhodesia, **26B:** 653–738.—The above four papers comprise approximately the first half of a new annotated check list of the passerine birds of Africa. This is the first comprehensive list of African birds since Sclater's *Systema Avium Aethiopicarum*, 1930, and is extremely welcome for bringing together the numerous revisions that have been scattered through the literature of the last 30 years.

Within the list, the order of families is that of Delacour and Vaurie (1957, *Contrib. Sci., Los Angeles Co. Mus.*, no. 16), with such variations as are necessitated by the publication of the Sylviidae separately. In the introduction to each part, the included families are discussed with citations of recent revisions, and any innovations in treatment are explained. Under each species heading is given the range of the

species as a whole, and each subspecies is followed by its range and a brief diagnosis of its characters. The latter is without question the most valuable feature of White's list, for not since Reichenow's *Die Vögel Afrikas*, 1901–1905, has variation over the whole continent been summarized. Anyone who has experienced the frustration of trying to compare the varied treatment accorded the same subspecies in different regional lists will appreciate White's contribution. The synonymies include all forms described since Sclater, and names recognized in Sclater that have since been placed in synonymy. In the treatment of synonyms, those subspecies that show the postulated characters to a moderate degree, but not sufficiently for nomenclatural recognition, are marked with an asterisk, a useful convention introduced by Vaurie (1959, *Birds of the Palaearctic Fauna*). One of the weak points in his recognition of subspecies is White's failure to cite recent revisions at the generic and specific level, either his own or those of other authors. Even if he had only cited his own revisions in recent volumes of the *Bulletin of the British Ornithologists' Club*, written during the preparation of the present volumes, it would have been a great step forward, for in those he justifies the many changes that he has made.

In his treatment of family limits, White introduces no changes of consequence. Thus far he differs from Delacour and Vaurie only in including the Prionopidae in the Laniidae as was done by Rand (1960) in Peters' *Check-list of birds of the world*, vol. IX. However, there are certain shiftings of genera between families that may lead to confusion, particularly in view of the probable lack of any index for the completed volume (see below). *Pholidornis* and *Hylia* have been removed from the Ploceidae and Nectariniidae respectively, and placed in the Sylviidae, by no means for the first time, and *Namibornis* is now in the Turdinae instead of the Muscicapinae. *Muscicapa gabela* Rand has been removed from the Muscicapinae and placed in *Sheppardia* in the Turdinae following Hall (*Bull. Brit. Orn. Club*, 81: 45, 1961). Unless a footnote marking this change appears in the forthcoming section on the Muscicapinae, this species may well be lost to anyone unfamiliar with Hall's paper. *Stizorhina* also appears as a thrush, following Chapin's treatment (1953) in *Birds of the Belgian Congo*. In general White uses the broad genera of modern usage, too broad, I feel, when he places *Melocichla* and *Achaetops* in *Sphenoeacus*, but he has resurrected *Andropadus* in the Pycnonotidae. He also uses the broad species concept. In his recognition of subspecies he is almost ultraconservative, and sinks his own along with those of other authors impartially and sometimes uncritically.

My main criticism of the present check list lies with its mechanical faults, and these were probably beyond the author's control. It is a disgrace that no institution in either Africa or England could see fit to publish this work as a whole, or if in parts, at least in parts that are consecutively paged. Not only are the present parts in two different page sizes and formats, but all are paged separately. This makes it impractical if not impossible to produce a workable index, and in cases like those cited above, genera and species that have been moved to unfamiliar families are almost lost. In its present unwieldy form, White's list can never become the useful and readily available tool that Sclater's is, which is a pity. White is working under considerable handicaps. As a member of the Provincial Administration in Northern Rhodesia he has had no direct museum connections, and most of his taxonomic studies have been confined to his periods of leave, either at the British Museum (Natural History) or the National Museum of Southern Rhodesia in Bulawayo. Certainly a work of this import should have received more support than it has, but we must be grateful that it is being published at all, and all students of African birds will eagerly await the publication of the remaining parts.—MELVIN A. TRAYLOR.

Functional anatomy of the feeding apparatus in waterfowl. (Aves: Anatidae.)—Donald C. Goodman and Harvey I. Fisher. Carbondale, Illinois, Southern Illinois University Press, 1962. xi + 193 pp., 11 text-figs., 40 tables. $6.50.—Despite the enormous literature on the Anatidae this book represents the first comparative study of structural adaptations for feeding in the family. In addition to specific information on ducks, geese, and swans, anatomical principles and methods of broader application are also presented. One odd feature of the book is its format—green cloth cover, yellow dust jacket, quality paper, popular layout—which will be more attractive than its contents to the average ornithological reader. Those interested in waterfowl, functional anatomy, and adaptation, however, will find the book rewarding.

Under consideration are 12 per cent of the living species of the family Anatidae, including one or more representatives from eight tribes. Following an introductory section on methods of recording and analyzing certain anatomical data, the food and feeding habits of all 17 species are discussed. Information on natural feeding methods is summarized from the literature, but the authors also compared some captive birds in their ability to handle grass in a piece of sod, dried and fresh corn on the cob, and corn meal in a pan of water.

The description of feeding behavior is adequate for some of the species covered but practically nothing is said about the precise feeding methods of the Black Brant, Kelp Goose, Shoveler, Canvasback, Surf Scoter, Goldeneye, Oldsquaw, and Hooded Merganser. All 17 species are nevertheless classified in a summary table by feeding method—grazer, graze-strainer, strainer, grasper—and by their principal food and bill action. Presumably the feeding methods of the species listed above were largely inferred from their food and anatomical structure.

Variations of the rhamphotheca are described in considerable detail, revealing differences in absolute and relative width of the nail on the upper jaw and in the spacing, shape, and direction of each row of lamellae. Although these differences correlate quite well with the basic feeding methods there is still much to be learned about the Canvasback, Surf Scoter, Goldeneye, and Oldsquaw, which are stated not to strain their food but which have well-developed blade-like lamellae.

A comparative section on the osteology of the skull deals mostly with absolute measurements and ratios of these measurements to cranial length. The mean and variation of these measurements and ratios are tabulated for samples of all 17 species. The tables of actual measurements "are included in their entirety because of future usefulness, particularly to paleontologists, and because they constitute a mass of data for further interpretation by other workers." Unfortunately the *precise* method of taking these measurements is not always given and some of the data are thus of no use to the paleontologist, and are greatly restricted in other uses.

Among the interesting adaptations discussed in detail are the flattening and widening of the skull in the Common Merganser, by which "a multitude of adaptive modifications for an efficient fish-eating habit are secured at one time; streamlining, strength, stability, increased swallowing capacity, and rapidity of movement." Other by-products of the broad cranium are the reduced orbital process of the quadrate and the small size of *Musculus pseudotemporalis profundus*. In the species studied, width of the frontonasal hinge, length, depth, width, and taper of the bill, and other features, can be explained to some extent in terms of feeding behavior.

A general description of each jaw muscle is presented with comments on intra- and interspecific variation. The terminology and interpretation follows Lakjer (*Studien über die Trigeminus-versorgte Kaumuskulatur der Sauropsiden*, Kopenhagen, 1926). Muscles of the head and anterior one third of the neck are illustrated, showing mostly

Branta canadensis and *Mergus merganser*. Similar descriptions and illustrations are offered for the anterior neck muscles and muscles acting on the tongue. (*M. cucullaris, caput part* of Goodman and Fisher is synonymous with *M. complexus* of most authors.) Ligaments of the skull are described, but discussion of their functions is rather sketchy and differences between species are not explained. The muscles of the species studied are basically similar in configuration, with the exception of *Mergus merganser*, in which a part of *M. adductor mandibulae externus superficialis* is absent, *M. adductor mandibulae posterior* is two-parted, and other jaw muscles are somewhat shifted or reduced. These and other differences in the species studied were explained as feeding adaptations.

The authors have made a comparative analysis of the potential abilities to abduct and adduct the lower jaw, and protract and retract the upper jaw, in the 17 species. Each of the jaw and neck muscles was weighed, and the average weight of each muscle used as an index of the force of contraction of the muscle. The geometry of the bony mechanism moved by the jaw muscles was transferred to paper by direct measurements from specimens, and formulas for abduction, adduction, protraction, and retraction were applied to each species. An index of potential force at the tip of the closed jaws was thus calculated for each muscle of each species, and tables of all pertinent data for these calculations are presented. This quantitative analysis has produced some interesting results. It is demonstrated, for example, that interspecific variation in muscle size or angle does not necessarily cause differences in jaw action. The Canada Goose and Common Merganser both achieve strong adduction through *M. pseudotemporalis superficialis*—the merganser by a larger muscle force and angle, the goose through a longer force arm and shorter work arm. By charting the index of total effective force of abduction, protraction, adduction, and retraction of "strainers" and "graspers" against body weight, the authors show that these two groups form different curves, and that effective force always increases with body weight but at different rates—relatively more rapidly in strainers than in graspers. (The Canvasback is here included as a strainer though listed as a non-strainer in a previous table.)

A number of adaptive patterns are discussed. The Canvasback may expose buried aquatic tubers by probing and powerful gaping, and the Surf Scoter is evidently adapted to remove mussels from the substrate by powerful biting. Biting power is large in grazers (mostly because of their short bills) and small in strainers. The figures presented indicate that in the ducks studied, "the ability to retract the upper jaw is consistently less than the ability to adduct the lower jaw" and "the total effective force of protraction is always smaller than that of abduction, retraction, or adduction."

The method used to estimate relative forces in the jaws of birds is interesting and fruitful. It does, however, have its limitations of accuracy and application. The fact that it is "quantitative" does not necessarily mean that it is accurate. To cite some of the weaknesses or limitations: (1) the work arm is measured from the tip of the bill, a reference point of variable functional importance in different species; (2) differences in restrictive forces (muscle masses, ligaments, etc.) are not taken into account; (3) methods of measurement require many assumptions which oversimplify the complex jaw mechanism; (4) the index of muscle force is based on weight alone —differences in muscle structure are not considered; (5) misinterpretation of a muscle's action may cause serious errors in estimation of total adduction, retraction, abduction, and protraction. The authors have assumed single actions for each jaw muscle except *M. adductor posterior* and *M. pseudotemporalis profundus*, which were

analyzed for both adduction and retraction. They have ignored the following actions postulated by other workers: retraction by *M. adductor mandibulae externus*, adduction by *M. pterygoideus*, and protraction by *M. depressor mandibulae*. Had these actions been included there might have been less disparity between total effective adduction and retraction, or between protraction and abduction in the various species.

There are very few typographical errors. Figures 10 and 11, however, are not labeled as such and are transposed; 11 is on the left, 10 on the right. Some of the text is needless repetition of specific results appearing in tables and many tables are occupied with data concerning methods which are of no interest to the average reader. These additional pages and the lavish format contribute to the excessive price of the book.

Although members of eight tribes of the Anatidae were studied, the authors drew very few taxonomic conclusions. (The two mergansers studied differ from the other species in numerous features "which may be of importance in characterizing the subfamily Merginae.") As a functional-anatomical study, however, the book is important for its methods and interpretations.—RICHARD ZUSI.

Exploration du Parc National Albert et du Parc National de la Kagera—II. Contribution à l'Étude des Vertebrés Terrestres en Afrique Tropicale—Fascicule I. —Kai Curry-Lindahl. Brussels, Inst. des Parcs Nationaux du Congo et du Ruanda Urundi, 331 pp., 22 pls., 92 text-figs.—The modern American ornithologist tends to view the lavish and bulky publications of some of the European Institutes with a certain awe and, perhaps, jealousy. Trained to prune every unnecessary word and nonessential photograph, he may open a volume like the one under review with prejudicial misgivings. His reservations are not dispelled as he turns page after page of accounts of field encounters with very little quantitative data or specific detail. The photographs are attractive and nicely reproduced on heavy glossy paper, but rarely add more than a decorative touch to the comfortably smooth text.

Dr. Curry-Lindahl's book belongs to this class but contains among its many pages a wealth of interesting material. The present volume, the first of two, contains a brief description of the physiography of the areas under consideration, followed by accounts of all the species of amphibians, reptiles, mammals, and birds observed by the author during two short expeditions to the Congo and adjacent areas of tropical Africa. A nine-page English summary provides a welcome key to points of special interest. The bird section covers the non-passerines in 158 pages. The passerines will be treated in the second volume. Observations made outside of the parks have been published separately in two volumes in the *Annales du Musée Royal du Congo Belge*. The present work restricts itself to observations made in the two parks during March and April, 1952, and January, February, and April, 1959. Personal observations are supplemented by references to the published accounts of other naturalists, notably Gyldenstolpe, Chapin, Lippens, Schouteden, and Verheyen. Several first records for the parks are recorded.

Dr. Curry-Lindahl's primary objective in visiting this region of Africa was to obtain information on the gonadal development and molt of Palaearctic birds wintering in or passing through the area on their northward migration. He is a remarkably keen observer and his descriptions of migrating flocks of shore birds, terns, etc., constitute one of the best features of the work. Traces of territorial behavior were noted in several of these birds as individuals lay over for considerable periods along

the shores of Lake Edward. Ruffs, in particular, were watched, some individuals advanced in the molt showing territorial behavior while others were simultaneously giving group displays similar to those given on the European breeding grounds. Interesting observations were made on the interaction of different species of vultures feeding on carcasses.

Basic information on the ecology and behavior of tropical species and of northern migrants in tropical regions is still very sketchy. Kai Curry-Lindahl's contribution in this book is a considerable one, well presented with the insight of a highly competent modern biologist.—JOHN T. EMLEN.

The birds of Nova Scotia.—Robie W. Tufts. Nova Scotia Museum, Halifax, 1963. xvii + 481 pp., 40 col. pls., 30 drawings, endpaper maps. Cloth. $7.50 plus postage.—In general makeup this book has much in common with the volume on Newfoundland by Peters and Burleigh (1951), rather than the thin but excellent paperback on New Brunswick by Squires (1952). It is 50 pages longer than the former. Front matter includes general information on the Province and its climate; the bulk of the book treats 4 "unsuccessful introduction attempts," 321 species and subspecies known to have occurred, and 19 hypotheticals. There are 158 breeding species, not including the Gannet (extirpated) and Passenger Pigeon. When full treatment is accorded, headings are: status (includes habitat and some migration data), description (very brief), breeding (often many local data), range (total), and remarks (historical information, habits, sometimes field identification or discussion of subspecies occurring, food, etc.). Rarities are treated tersely—details of the few records, occasionally added "remarks." Most offshore and pelagic birds get comparatively brief treatment, due to lack of useful information.

This is an easy book to read, written by a lifelong, dedicated student whose own titles in the 10-page bibliography span the years 1915–1959 inclusive. In addition to filling the needs of amateurs and others in the Province, it is very useful generally—for distributional and seasonal data, nesting dates, and many local observations. Examples: county-by-county status of the Willet, which is extending its breeding range; telescope observation of a Rough-legged Hawk that caught and ate four mice, then watched (but made no move to attack) a rat that approached it closely; no "dustings" found near Spruce Grouse nests and belief that, in the interests of survival, the female flies a considerable distance when leaving and returning.

Until 1958, Tufts had never seen more than about 50 Golden Plovers at a time ("uncommon fall transient"); that year he saw a flock which increased to some 300, with a ratio of at least 3 "immatures" per "adult." Thus, with no reported evidence that the Golden Plover is plentiful in fall in either Nova Scotia or Newfoundland, a mystery remains: do southbound flocks pass over non-stop, or just what do they do at that season?

Thirty-two color plates by Peterson are borrowed from the Newfoundland book and, though entirely appropriate for that island, they seem a trifle somber for their new setting. (That four-toed Three-toed Woodpecker, incidentally, has shed its superfluous anatomy in making the flight across Cabot Strait!) The added eight plates by John Crosby also are composites, some very crowded, but the small birds are notably well done; there must be a considerable difference in vividness between the originals and the press run. John Dick's sketches are original in concept and lively. Altogether, this is a very welcome volume.—RALPH S. PALMER.

The biosystematics of American crows.—David W. Johnston. Seattle, University of Washington Press, 1961. Offset, 119 pages, 6 figures, 11 tables. $3.25.—This is by far the most ambitious and carefully done study of variation yet attempted for the difficult group of American crows. It is based on the analysis of variation in color and measurements of 2,269 breeding adult specimens and a few samples of first-year birds as well. Seasonal changes in color have been taken into consideration, and samples used in the analysis of measurements have been refined by segregation of age groups. The four measurements used—bill, wing, tail, and tarsus—have been analyzed statistically for samples of more than 10 specimens, and standard error, standard deviation, and coefficient of variation are given for such samples, in addition to mean and range. There are also sections on habitat preference and voice for each species for which these are known. Unfortunately, the usefulness of the statistical analyses of mensural variation is seriously impaired because of the author's confusion of standard error and standard deviation. Despite a discussion (pages 19–20) of the various criteria which have been proposed for the separation of populations on a statistical basis, Johnston uses two standard errors as his criterion of significant difference between two samples, a statistic which has nothing whatsoever to do with the separation of the individuals of one sample from the individuals of another. Thus, whenever the author claims a significant difference in measurements between two samples, the reader must check significance each time against the data presented in tabular form for each sample. The Dice squares given for the various samples of the Common Crow are, apparently, not to be trusted for such checking, as the series of Dice squares purporting to give data for tarsal measurements of samples of adult males are actually for samples of adult females, and vice versa. It is recommended that readers use the data given in the tables as a basis for their own tests of significance.

There are a number of changes from recent treatments of these crows (American Ornithologists' Union *Check-list of North American birds*, 5th edition, 1957; *Check-list of birds of the world*, volume 15, 1962). Johnston reduces *C. brachyrhynchos paulus* of the southeastern and Gulf states to a synonym of typical *brachyrhynchos*; this action appears to be warranted on the basis of the measurement data presented. *C. caurinus* is considered to be a race of *brachyrhynchos*. This lumping appears to be justified on the basis of extensive field work on the two forms carried out by the author in Washington, with the discovery of populations intermediate geographically, mensurally, and vocally between *caurinus* and *C. b. hesperis*.

The eastern and western populations of the Mexican Crow, *C. imparatus*, are considered to represent different subspecies, *imparatus* and *sinaloae* respectively. The discussion of this situation is of particular interest, since the primary difference between these populations is in voice. This difference was first pointed out, on the basis of excellent audiospectrographic evidence, by L. Irby Davis (*Wilson Bull.*, 70: 157–164, 1958), and primarily on this basis, with some supporting evidence of a lower wing/tail ratio in the western population, Davis named this population as a distinct species, *C. sinaloae*. The *Check-list of birds of the world*, while admitting the voice differences established by Davis, withheld recognition of *sinaloae*, at any level, because no valid morphological difference had been demonstrated between the eastern and western populations. The recognition of the western population as a distinct entity by Johnston seems, to me, a distinct advance over that sterile approach. Johnston supplies more refined information on wing/tail ratios in the two populations, but there is no significant difference between them in this character, despite a statement to the contrary, again based on faulty interpretation of statistics. The author's problem, then, was whether to recognize *sinaloae* as a distinct species or only

as a subspecies of *imparatus*. He spends five and one-half pages leading up to his conclusion that *sinaloae* is only a subspecies of *imparatus*. This includes a rather determined effort to minimize the importance of the voice differences involved, despite the fact that the author disagreed (page 5) with Hellmayr and others that *C. brachyrhynchos* is conspecific with the Carrion Crow (*C. corone*), pointing out that there are "at least significant voice differences" between the two forms, and again despite the fact that one of the strongest arguments he had in favor of lumping *brachyrhynchos* and *caurinus* was the discovery of voice populations intermediate between the two. It seems obvious that Johnston is trying to cope with the dilemma that always faces the taxonomist trying to come to some conclusion about the status of two widely separated allopatric populations of obviously close relationship. Despite the title of this book, and the emphasis in the introduction on the importance of biological features in systematics, it is evident that the author is guided here, and in a number of other cases as well, primarily by morphology and not by biology. I have no fault to find with Johnston's conclusion, but it was with some surprise that I read in the summary (page 106) that: "Analysis of characteristics of the allopatric populations of *imparatus* revealed the fact that the differences (size and voice) between them are of a subspecific nature. . . ." when, obviously, no "fact" of any kind was revealed about this relationship.

Finally, Johnston does not recognize *C. palmarum minutus*, thus returning *palmarum* to monotypic status. This is justified by the author's exposition that the supposed color differences between the races of *palmarum* are based on comparison of seasonally different samples.

Of interest is a discussion of the possible isolating mechanisms which prevent interbreeding between *C. brachyrhynchos* and *C. ossifragus*. Johnston feels that the most effective mechanism may be seasonal isolation, previous observers having pointed out that the Common Crow frequently nests a month or more earlier than the Fish Crow. However, the graphic summary of breeding records presented in figure 4 shows that, although there is a considerable degree of seasonal isolation between these species in the southeast, there is considerable seasonal overlap between them in the northeast. This is hardly compatible with Johnston's statement that there is "a strong degree of seasonal reproductive isolation between these two species." Indeed, the most interesting facts shown by the figure are the great temporal uniformity in the breeding season of *ossifragus* throughout its range and the striking clinal change from early to late breeding in *brachyrhynchos* as one goes from south to north. This suggests rather strongly the relative climatic stability in the coastal environment of *ossifragus*.

Brief sections on trends in weight in the Common and Fish crows, and on host–parasite relationships involving Mallophaga as suggestive of relationships in the American crows, suffer from lack of adequate material and support no definite conclusions. A final brief section on phylogeny is purely speculative and adds little useful information.

Despite the title of this work, its chief contribution is the careful analysis of morphologic variation in the American crows. This serves to correct a number of erroneous interpretations by previous workers and puts the taxonomy of the American crows on a solid foundation.—JOHN DAVIS.