REVIEWS

EDITED BY WALTER BOCK

Handbook of the Birds of India and Pakistan, together with those of Bangladesh, Nepal, Sikkim, Bhutan and Sri Lanka.—Salim Ali and S. Dillon Ripley. 1971–1976. Bombay, London, and New York, Oxford University Press.—The "Handbook of the birds of India and Pakistan" by Ali and Ripley is a major 10-volume ornithological review of the fauna of the great Indian subcontinent. The first four volumes were reviewed by Joe Marshall (Auk 87: 816–818, 1970; 89: 207–209, 1972) to which the reader is referred for a discussion of the project's scope and an evaluation. The present review covers the last six volumes, which treat all the passerines except the pittas, which are in volume 4. Instead of evaluating the passerine material in detail, I shall present an overview of the whole series.

Publication of such a monumental survey in 10 volumes over a span of 8 years results in a number of technical points that should be mentioned. In these times of rapidly changing politics and national events, not even the title of an ornithological work is safe, as shown by the change in the subtitle of this handbook. Originally the subtitle read "together with those of Nepal, Sikkim, Bhutan and Ceylon" but with the publication of volume 8 (1973), it read "together with those of Bangladesh, Nepal, Sikkim, Bhutan and Sri Lanka." And it should be noted that the territorial concept of Pakistan in the main title is not the same at the end of the series as in the beginning. The authors present (vol. 8: xiv and subsequent volumes) a list of changes in territorial limits and names. Altering in the handbook title could cause citation problems. I recommend citing the whole series, including the first seven volumes, by the latter title.

A second problem is the year of publication, because the date in several volumes does not always coincide with the information made available to me by the publisher; these dates are listed below with the date printed in the volume given in parentheses if it differs from that provided by the publisher. I would also like to use this opportunity to provide the most recent price of all ten volumes as follows (the earlier dates are those of publication in India, the later ones in America, citations should use the earlier dates).

1, Divers to hawks, 380 pp, 1968, out of print[1]
2, Megapodes to Crab Plover, 345 pp, 1969, $20.00[1]
3, Stone curlews to owls, 325 pp, 1970 (1969), $19.75
4, Frogmouths to pittas, 265 pp, 1970, $21.75
5, Larks to the Gray Hypocolius, 276 pp, 1972, $17.50
6, Cuckoo-shrikes to babaxes, 245 pp, 1971, $20.00
7, Laughing thrushes to the Mangrove Whistler, 236 pp, 1973 (1972), $17.00
8, Warblers to redstarts, 277 pp, 1973, $21.75
9, Robins to wagtails, 306 pp, 1974 (1973), $20.00
10, Flowerpeckers to buntings, 344 pp, 1976 (1974), $20.00

The "Handbook of the Birds of India and Pakistan" is a monumental and masterful analysis of the avifauna of the Indian subcontinent, covering a total of 2,060 species and subspecies. The importance of the project is underlined by the decreasing number of ornithologists with a breadth of knowledge of natural history, systematics, and distribution who could undertake such a project in the future. This decrease of ornithologists possessing a broad overview of a large avifauna has been demonstrated clearly to me by my failure to find a competent reviewer of this handbook; I surely am not. During my entire tenure as Review Editor, I have tried without success to find a reviewer for this work, and have been forced to undertake the task myself because of its importance. Hopefully with the help of some expert advice, I will be able to do justice to these volumes.

The entire avifauna of the Indian subcontinent has been covered in this handbook using a good up-to-date taxonomy for the species and subspecies. A total of nearly 2,100 forms (species and subspecies) of some 1,200 species are covered. Each form is given a reference number that corresponds to the number in Ripley's "A synopsis of the birds of India and Pakistan" (1961).[1] All species and subspecies are cross-indexed with Baker's "Fauna of British India, birds." Two new species are added in the addenda to volume 10, the Rednecked Grebe (*Podiceps griseigena*) in volume 1 and the Egyptian Nightjar (*Caprimulgus aegyptius*) in volume 4. The descriptions are good, but it is sometimes difficult to obtain a visual picure from the text description.

[1] According to Dr. Ripley vol. 1 and hopefully vol. 2 will be reissued by Oxford University Press with additions and corrections. He has also brought his *Synopsis* of 1961 up to date for republication in Bombay, hopefully within a year.

Color illustrations of all species are included. Many of the color plates are from previously published books, some of which are out of print; the rest of the plates were prepared especially for this handbook. Some races that are illustrated are not found in the area covered by these volumes which can cause some difficulties. Not all of these species are shown in plates close to the text discussion, and some are far out of place. Two species of swallows are illustrated in plate 108 (of a total of 113) in volume 10; swallows are treated in volume 5. Yet when one turns to volume 5, the correct reference to plate 108 is given showing that the format of the entire set of 10 handbook volumes, including the plates, was carefully planned at the onset of the project. Each bird on the color plates is identified by its scientific and English names and with its reference number. The plates are attractive and generally quite good. Unfortunately the sources of the reprinted plates are not given; this information would have been useful to non-Indian specialists such as myself. The keys are good and work well in general; but one must identify the bird to family or subfamily before the keys can be used.

Salim Ali has contributed a vast amount of previously unpublished natural history data which constitutes an important contribution of these volumes. Moreover an excellent job was done summarizing the literature and unearthing information from sources such as Whistler's unpublished notes. Distribution, status, and habitat have been updated as far as is known. The well-presented maps are a very useful feature of this handbook. Unfortunately Mercator projection maps of the Eurasian land mass were used, which deemphasize the area the handbook covers. A detailed map of the handbook area is not included nor is a gazetteer of place names. Some place names mentioned are no longer in use. And in some cases the distribution is described from district to district without saying in which state the districts are.

The last six volumes on the passerine birds have better species descriptions than those given in the first four volumes. It is possible to get a good feel for the plumage pattern of the bird.

Volume 10 contains an eclectic bibliography of the 744 titles on the birds of the Indian subcontinent up to the end of 1972. It also contains a consolidated index of scientific names and one of common names: My review copy of volume 10 is lacking pp. 311–314—the center sheet of the signature—of the index, the only major error of printing that I have found. Most of the shortcomings of these volumes have been covered by Marshall in his reviews of the first four volumes and need not be repeated here.

The "Handbook of the Birds of India and Pakistan" can be summarized as a superb summary of the birds of the Indian subcontinent. The authors gathered, summarized, and compiled the knowledge of the status, distribution, habitat, and life history of these birds and presented it clearly and concisely. They attempted a limited review of the subspecies of the birds of the handbook region. The major criticism is that the authors attempted few new things even when they could have been readily done, such as remeasuring an adequate sample of each taxon and presenting the results in a more complete way (sample size, mean, and standard deviation in addition to the range). The original choice of format with each subspecies treated as a separate unit and the inclusion of color plates resulted in a much larger and more expensive work, well beyond the financial abilities of most individuals and many libraries. This 10 volumes costing almost $200 could have been reduced to one-half or even one-third of its size without reduction in content and quality with a different scheme of organization. Yet these criticisms fade away in the light of the fact that Ali and Ripley have made available to us a thorough and excellent account of a major avifauna of the world. Moreover they completed the publication of the 10 volumes within a period of 8 years, so that the last volume appeared before the information in the first volume became stale and out of date. They presented a summary of this avifauna that records the knowledge of the distribution and habitat of these birds before the habitat and the birds are completely disrupted. The "Handbook" will remain the standard reference to the "birds of India and Pakistan, together with those of Bangladesh, Nepal, Sikkim, Bhutan and Sri Lanka" for many decades. All ornithologists are indebted to Salim Ali and S. Dillon Ripley and their coworkers for this excellent treatise. The Bombay Natural History Society and Oxford University Press are to be congratulated for their roles in sponsoring and publishing it.—WALTER J. BOCK.

Ecology and evolution of communities.—Martin L. Cody and Jared M. Diamond (Eds.). 1975. Cambridge, Belknap Press of Harvard University Press. Pp. ix + 545, illus. $35.00.—Robert MacArthur had a profound influence on the development of modern ecology and population biology, fostering especially the emergence of community ecology from a descriptive to an analytic science. His ideas about avian ecology were the cornerstone of the broader applications of his theories and richly warranted the Coues Award that was conferred by the American Ornithologists' Union in 1974. A year after MacArthur's tragic death in November 1973, his colleagues met at Princeton in a memorial symposium. The papers in this volume grew out of that gathering and portray the spirit and diversity of approaches and questions that MacArthur inspired in his associates.

The 18 chapters are organized into 3 sections. The first considers aspects of the diversity and relative abundance of species, how these may be analyzed, and how stable the relationships may be. The following section deals with the strategies employed by coexisting species for the division of limiting resources. The final, longest section details the ways in which communities are structured, how this structure may develop, and how the organization is determined by forces of competition and predation. The two concluding chapters deal in a broader manner with MacArthur's contributions to ecology and look to the ways in which his ideas may develop or be applied in the future. Altogether, the contributions provide a broad but somewhat disjointed synthesis of where MacArthur's ideas have led his followers and how they may influence the further development of community ecology.

In his 1972 book, *Geographical Ecology* (Harper and Row, New York), MacArthur observed that "To do science is to search for repeated patterns, not simply to accumulate facts, and to do the science of geographical ecology is to search for patterns of plant and animal life that can be put on a map." MacArthur's work exemplified the formative stages of this search for and understanding of patterns, and the contributions in this volume indicate how far his students and colleagues have taken it. There are papers dealing with plants (Schaffer and Gadgil, Horn), butterflies (Shapiro), stream plankton (Patrick), lizards (Pianka), birds (Hespenheide, Cody, Karr and James, Diamond), mammals (Rosenzweig, Brown), and a little of everything (Hutchinson). Some contributions clarify existing models of species patterns; May's chapter, for example, provides a detailed assessment of species abundance models and attempts to determine which patterns are truly elements of the biological structuring of communities and which are merely statistical consequences. Other papers (e.g. J. MacArthur) deal with well-known patterns, such as the broadly defined latitudinal gradients in species diversity, in the light of additional environmental variables (in this case, winter–summer differences in mean temperature). Still other chapters develop new ways of revealing and perhaps understanding the patterns of communities. Much is made, for example, of Levins' development of loop analysis, which provides a mathematical framework for portraying the logical and some not-so-logical consequences of species interactions, and the ways in which these may contribute to community evolution.

Several of the papers deal at length with bird communities and thus merit special comment here. A good deal of current theory holds that regular size differences between closely related coexisting predators imply corresponding differences in the sizes of prey taken, thereby permitting coexistence in the face of potential competition. Hespenheide addresses this dogma, using rather undetailed information on the diets and body sizes of several major groups of birds. There are indeed patterns, but they are subject to a variety of influences: differences in foraging behavior, prey type preferences, and the extent of intraspecific social aggregation may all modify the body size/prey size relationship. Studies that attempt to infer ecological relationships directly from morphological measures are thus subject to the caveat that "it all depends." Karr and James also convincingly demonstrate the hazards of developing ecological generalizations from measures of single morphological features, but in an entirely different manner. Using the multivariate tools of principal components analysis and canonical correlation to consider suites of ecological and morphological traits at once, they discern patterns of convergence in the overall eco-morphological configurations of forest avifaunas in Panama, Liberia, and Illinois. Unfortunately, the ecological categories are of necessity quite broad, and the morphological analyses consider only measurements recorded from a single male specimen for each species, so the details of community organization and population variation cannot be evaluated.

Cody's paper, prompted by the premise that similar forces of natural selection in similar but separated environments should produce similar optimal solutions of community structure, considers in some detail the patterns of species diversity on several geographical scales, emphasizing the breeding bird assemblages of Mediterranean climate habitats in California, Chile, and Africa. The paper is packed with inventive analyses of his observations (which are tabulated in several appendices). These lead to the conclusion that local within-habitat diversity can be explained adequately by theories of competition and limiting similarity of species, while differences in regional or between-habitat diversities among the three continents reflect the influences of history and chance. Cody treats the accumulation of species numbers with increasing area and habitat diversity on continents in a truly innovative fashion, but the treatments (and the conclusions) are marred by defects in the basic observations. Avian community composition was gauged by a series of short-term surveys at many locations, using small (4–10-acre) census areas; the duration and spatial scope of the surveys may have been too short and too small to census accurately the actual breeding assemblages, although the most abundant species were undoubtedly encountered. This inadequacy of the censuses is apparently compensated for by including in the tabulations species that were "expected" to occur in a census but did not do so. The main thrust of the analysis considers the distributional spread and turnover of species along habitat gradients in the three continents, but where most of the occurrences of a species along a gradient are by "expectation" rather than actual sightings (e.g. 3 of 4 census locations for *Amphispiza belli* in

California, 6 of 7 for *Parisoma subcaruleum* in Africa, and 13 of 45 species in a "supersaturated" California habitat), one becomes uneasy about the reality of the patterns. The habitat gradients are scaled by features of vegetation profile, which operationally seems to carry the assumption that all important factors in determining avian community patterns are incorporated in these measures.

Diamond's massive (102-page) chapter presents the details of avian community composition on New Guinea and its many satellite islands, and detects several "assembly rules" for avian communities. These are dictated by resource competition: "Communities are assembled through selection of colonists, adjustment of their abundances, and compression of their niches, in part so as to match the combined resource consumption curve of all the colonists to the resource production curve of the island. Members of permitted combinations must also be 'companions in starvation'—i.e. must be similar in their tendencies to overexploit and in their tolerances for lowered resource levels, thereby starving less tolerant species off the island. Thus consumer species form hierarchies with respect to exploitative strategy." These are important and controversial ideas; unfortunately there seems no ready way to test them except in highly fragmented, well-studied archipelagos. Diamond interprets his findings in the context of diffuse competition, the web-like net of competitive interactions among many members of communities. Diffuse competition, however, is even more difficult to demonstrate than direct competition and seems to be used as an explanation of community patterns when interpretations based on simple direct competition theory fail.

The characteristics of the "MacArthur School" approach are apparent in most of the contributions. Interpretations of patterns are frequently made in an evolutionary context, with reference to adaptive costs and benefits. The observations that provide the fodder for theoretical development are usually derived from short-term (typically one year) surveys of areas, rather than from experimental manipulations or long-term intensive studies. We are often asked to accept the observations as valid samples of natural community organization without knowing the methods or circumstances of their collection. The emphasis is seemingly on the analysis of the data and on generating intuitive or mathematical models that generally agree with the observations. In most treatments, competition is viewed as the major force driving the development of community patterns (the papers of Patrick and of Connell are notable exceptions), although the role of competition is only inferred from the patterns of differences among coexisting species or from the distributional patterns of presumed competitors. The natural communities are nearly always presumed to be at or near equlibrium, but given only single-year surveys, there is really no way to tell whether this assumption really holds. A massive and at times truly elegant and novel complex of analyses is thus built upon a data base that is gathered in a rather cursory way and upon assumptions that are untested but questionable. Despite these apparent inadequacies of the approach, broad patterns in community organization do emerge, and the analyses lead to some interesting interpretations of the patterns, at least some of which can be formulated as testable hypotheses. MacArthur, after all, was interested in principles that held generally, that could explain the major portion of the variable patterns of nature. Perhaps intensive, detailed, long-term and complete studies of local communities are not really required to reveal the broad outlines of these patterns, and if that is so the contributions in this volume have a great deal to say about the organization of communities. But MacArthur also believed that this sort of ecology is perhaps best pursued by field naturalists who know theory and can place their observations in that context. As one reads through this compendium of where the "MacArthur School" stands now, it is hard to avoid the feeling that the balance of theory with natural history advocated by MacArthur has swung toward theory and away from natural history.—JOHN A. WIENS.

Island biology illustrated by the land birds of Jamaica.—David Lack. 1976. Vol. 3, Studies in ecology. Berkeley, University of California Press. xvi + 445 pp. $25.00.—This book, written by David Lack shortly before his death in 1973, is based on 10 months of intensive field work on Jamaica during 1970 and 1971. It is, in part, a detailed account of the ecology of Jamaican birds. But Lack also uses *Island Biology* to state his views on the origin and evolution of island faunas, views reflecting more than three decades of observation on, and thinking about, island birds. This book is especially important because it provides an alternative to prevalent theories concerning island biogeography.

Lack's theme is that an island's avifauna reflects the heterogeneity of its environments and not its geographical isolation. According to Lack, taxa disperse readily enough even to remote islands so that the ecological space on islands is filled to the same degree as it is on continents. To support this idea, Lack gathered evidence both from his ecological studies on Jamaica and other islands, and from the geographic distributions of species within island groups. This evidence makes up the first half of *Island Biology*. The second half is a detailed, species-by-species account of the ecology of Jamaican birds. At the end of the book 29 appendices summarize Lack's observations.

Because *Island Biology* has so many facets, I shall use a corresponding number of perspectives in this review, examining the book as (1) a description of the ecology of Jamaican birds, (2) an exposition of Lack's theory on the faunal diversity of islands, (3) an alternative to other theories of island biogeography and ecology, and (4) a philosophical attitude toward science, which states that natural systems can be understood better by detailed observation of their structure and function (a 'close' view) than by testing predictions resulting from hypotheses about their organization (a 'distant' view).

Lack begins with an exposition of his theory of island biogeography. Next, he describes Jamaica and its habitats, the manner of ecological segregation between the land birds, the history of the avifauna, and geographical displacement of species within the West Indies. The remaining chapters in part 1 deal with peripheral topics including comparisons between Jamaica and other islands, the origin of the species of Jamaican birds, and the ecology of wintering warblers. Part 2 describes the ecology and systematics of each species belonging to the families of birds from pigeons through passerines. The 29 appendices of tabulated data include feeding observations, counts of species in various habitats, and geographical distribution. The book is concluded by a rather thorough list of references and indices to birds and islands, but not, unfortunately, to ideas and concepts. For the most part *Island Biology* is well written, but Lack sometimes repeats his points so often that they lose their impact, and he frequently lists so many examples as to make his narrative tedious and numbing.

Considering the diversity and uniqueness of the Jamaican avifauna, it has been the subject of surprisingly few ecological studies. Lack's bibliography lists only eight papers on Jamaican birds published since 1950. But in spite of the opportunities that Jamaica offers the ecologist and evolutionary biologist, Lack's account will be of little interest to the ornithologist who does not specialize in the Jamaican fauna; the book also is not suitable for the casual birdwatcher on Jamaica. It would seem that Lack wrote *Island Biology* more for himself than for a general audience. It is overly long for its accomplishments and Lack's ideas might have been more strongly presented and more widely read if they had been published in a scientific journal.

Simply stated, Lack's theory of island biology is that the habitats on an island determine the number of species on the island, with distance from the source of colonists playing a decidedly minor role. Lack also believed populations of birds on islands to be stable; once a population is established, its extinction and replacement by a new colonist is unlikely. How strong is Lack's evidence for these ideas? On the whole, it appears quite weak. To support his view that dispersal within the West Indies is not restricted by water barriers, Lack cited observations on movements of birds between islands and provided numerous anecdotal records of Caribbean birds as vagrants outside their normal ranges. Such occurrences, often of a single bird during the nonbreeding season, may have little relevance to the establishment of populations. If one can generalize from species currently invading the West Indies from South America—the Bare-eyed Thrush and the Glossy Cowbird—colonization follows widespread movements by large numbers of birds. Many individuals usually are seen before breeding populations are established and colonization proceeds in a steady progression from island to island rather than the haphazard fashion in which vagrants appear. Lack himself acknowledged the obvious effect of distance on the avifauna of such remote islands as Hawaii, but apparently was unwilling to concede an effect of smaller scale in the much closer Caribbean islands. Lack's opinion is all the more amazing considering that several families of mainland species, including most of the suboscine passerines, are absent from the West Indies where suitable habitats almost surely exist.

Discounting the effect of isolation, Lack explained variation in the number of species on islands, and the general poverty of island faunas compared to those found on continents, by the reduced variety of habitats available to birds—ecological impoverishment. The relation between habitat diversity and faunal diversity is evident among islands with low profiles and therefore lacking wet, montane habitats. But Jamaica rises to an altitude of over 2,000 m and its habitats range from extensive wet forests at mid elevations to more restricted xeric scrubs in the lowlands. In his Table 2, Lack distinguished 13 terrestrial habitats on Jamaica; there are 66 species of resident land birds. Lack made an extensive comparison of his data with Monroe's (1968, Ornithol. Monogr. No. 7) study of land birds in Honduras, where 389 species occupied a recognized 10 habitats, but he presented no evidence of Jamaica being ecologically impoverished. For a theory that rests so strongly on the ecological diversity of a region, the absence of adequate habitat comparisons is disappointing. Lack also ignored the influence of within-habitat heterogeneity, a function of the diversity and structure of the vegetation, on the number of species found in uniform habitats. There is no question that each island habitat has fewer species of birds than its mainland counterpart, yet it is doubtful that the structure of the island habitats is less complex in any way that is meaningful to birds (Cox and Ricklefs 1977, Oikos 28: 113–122).

Another facet of Lack's view of island biology concerns competitive exclusion among close relatives. If one assumed, as Lack did, that habitats were fully saturated on islands, one would predict that interspecific competition should be as intense on islands as it is on the mainland. To support this idea, Lack cited

examples of geographical segregation of closely related (ecologically similar) species within the West Indies. But, although Lack documents many interesting cases of adjacent, but nonoverlapping distributions, his survey is neither thorough nor systematic. Only those cases that support the theory are emphasized; the many instances of gaps between the geographical ranges of similar species and the many cases of generic sympatry are played down (13 genera of Jamaican land birds are represented by more than one species). It is easy to dismiss the contrary evidence suggested by sympatric congeners using the obvious points of divergence between them as a convenient out. But is it impossible to distinguish whether these differences are inherent and permit the species to coexist or whether they are the result of co-occurrence and subsequent divergent evolution.

Competition underlies another of Lack's ideas about islands, namely that, once established, island populations of birds effectively exclude new colonists having similar ecological requirements. Although island residents certainly may adapt to the peculiar conditions on an island, they typically occupy greater ecological ranges than their mainland counterparts. There is no theory of competition that, in general, would permit the regular exclusion of specialists by generalists, particularly in supposedly stable island environments. I do not presume to know the origin of Lack's idea concerning the stability of the island avifauna, but it is similar to Williams's (1969, Quant. Rev. Biol. 44: 345–389) strongly supported view of a similar nature on the anoline lizards of the West Indies.

If residents excluded new colonists, there would be little extinction and faunal turnover on islands. To support his contention that island avifaunas are stable, Lack pointed out that during the last 150 years—corresponding to the period of detailed avifaunal investigations—only two species have become extinct on Jamaica, both more than a century ago, and none has colonized the island without the help of man, despite the frequent appearance on Jamaica of vagrants from other islands and the mainland. Perhaps because he concentrated his attention on Jamaica, Lack overlooked the many cases of extinction throughout the West Indies (33 island populations of land birds have either become extinct in the past 150 years or are certain to become extinct soon (Bond 1968, 13th suppl. to the check-list of the birds of the West Indies, Acad. Nat. Sci. Philadelphia) and several cases of recent geographical expansion within the Lesser Antilles (Bond 1956, Check-list of the birds of the West Indies, 4th ed., Acad. Nat. Sci. Philadelphia). One could argue that most of these extinction and colonization events are the result of human disturbance, although this would be difficult to support in several cases. More to the point, 150 years of recorded ornithological history are hardly sufficient to make a case for faunal stability on an island that has been inhabited by birds for tens of millions of years.

Lack's views contrast strikingly with other hypotheses concerning island biogeography. In the preface to his book, Lack suggested that the differences between his theory and that of MacArthur and Wilson are less than he had once thought; Orians (1976, Science 194: 1153–1154) also played down differences between the two theories. I find them difficult to reconcile. MacArthur and Wilson stated that the faunal diversity of an island is the result of a balance between immigration and extinction of species. To be sure, many aspects of Lack's hypothesis can be accommodated by this equilibrium theory. Lack believed that birds disperse easily through the West Indies, in other words, that the immigration curves of the MacArthur-Wilson model are similar for all islands. Differences between islands would reflect different extinction curves. These are determined both by stochastic events and by competition, and are thought to increase as island size and ecological heterogeneity decrease. Fine, so far, but even if variation in faunal diversity depended upon the ecology of the island and not its geographic setting, MacArthur and Wilson's model would predict faunal turnover where Lack argued for competitive exclusion of immigrants by established residents. If colonization rates were uniform throughout the West Indies, depauperate islands should experience more rapid faunal turnover with each taxon having a shorter average life expectancy. The absence of distinctive endemic and presumably older taxa on small, depauperate islands (Mayr 1965, Science 150: 1587–1588, Ricklefs and Cox 1972, Amer. Nat. 106: 195–219) supports the MacArthur-Wilson view and weighs heavily against Lack's theory of faunal stability.

Lack's argument for uniform colonization rates or, rather, complete lack of contemporary colonization within the West Indies stimulated me to attempt to sort out the effects of distance and island characteristics on species diversity using a multiple regression-partial correlation analysis of the data in Appendix 10 of *Island Biology*. The dependent variable was the number of species of resident land birds; the independent variables were island area (transformed to its logarithm), altitude, distance from mainland, and distance to nearest island. The first two independent variables should provide an index to the variety and area of habitats on an island; the last two should provide a measure of geographical isolation. In partial correlation, the effect of each variable on the dependent variable is evaluated with the other independent variables held constant statistically, so correlations among independent variables do not confound the analysis. The results, presented in Table 1, indicate that within the Greater Antilles island area is the only factor that bears

TABLE 1

MULTIPLE REGRESSION-PARTIAL CORRELATION ANALYSIS OF FACTORS INFLUENCING SPECIES DIVERSITY ON WEST INDIAN ISLANDS[1]

Islands[2]	Sample size	Variable				
		Area	Altitude	Distance to mainland	Distance to nearest island	Multiple R^2
West Indies	38	0.75[3]	0.31	−0.27	−0.10	0.88
Greater Antilles	12	0.91[3]	0.07	0.30	0.02	0.96
Lesser Antilles	21	0.61[3]	0.56[3]	−0.78[3]	−0.46[3]	0.87

[1] Analyzed with UCLA Biomedical Computer Program BMD 03R.
[2] The five Virgin Islands are not included in either the Greater or Lesser Antilles samples.
[3] $P < 0.05$.

any relationship to number of species. Distance and, surprisingly, elevation are inconsequential. The analysis suggests, therefore, that within the Greater Antilles colonization rates are uniform. It should be pointed out that, among the Greater Antilles, island area and elevation are strongly related (correlation coefficient, $r = 0.80$) and island area varies over almost four orders of magnitude.

In the Lesser Antilles, where island area varies over only two orders of magnitude, all four independent variables are related significantly to number of species, with distance to the mainland having the highest partial correlation coefficient ($r = -0.78$). The effect of isolation is evident here, with diversity decreasing by 2.2 ± 0.4 species for every 100 km distance from South America and by 4.3 ± 2.1 species for every 100 km distance from the nearest neighboring island. Clearly, dispersal is important.

A topic not dealt with explicitly by Lack, but worth mentioning in the context of his book, is the origin of the Antillean avifauna and the source of its distinctiveness. Bond (1963, Proc. Acad. Nat. Sci. Philadelphia 115: 79–98) suggested that endemic Antillean forms are relicts of populations that were once extensively distributed on the mainland—that islands are isolated backwashes, relatively untouched by the mainstream of evolution on the continents. Lack supposed, in contrast, that island endemics were derived from mainland forms by adaptation to the particular conditions they encountered on the islands. Species that now differ greatly from their mainland ancestors occupy much different habitats, while those species that are undifferentiated did not experience such habitat change when colonizing the islands, even though they may be as old as endemic forms. Ricklefs and Cox (op. cit.) argued that the degree of distinctiveness of an island form reflects the age of the taxon on the island: endemic forms are old colonists, undifferentiated forms more recent immigrants. These authors additionally side with MacArthur and Wilson in arguing for extinction and faunal turnover.

The contrasting views of the origin of the Antillean avifauna held by Bond, Lack, and Ricklefs and Cox grew out of considering the same body of facts about the geographical distribution and taxonomic differentiation of island forms. Each of these views either explicitly or implicitly reflects the authors' particular concepts of evolution, diversification, ecological interaction, and extinction. Clearly, we cannot rely on a fossil record, which is negligible for birds, to resolve such differences. And I doubt that the kind of geographic and taxonomic data that has led to so many incompatible theories could eventually, through more detailed analysis, be used to test these theories.

Lack has argued that one way to circumvent the biases that color our interpretation of patterns in nature is to study the system in greater detail. This, in Williams (op. cit.) words, is the 'close view,' which, Lack says, "depends on the intensive study of a particular situation in all its aspects, from which conclusions are later drawn." I certainly agree with the value of such close views of nature. But while reading *Island Biology* I was struck repeatedly by Lack's failure to heed his own warning to seekers of 'distant' views, that "because nature is so various, one can with diligence find examples to illustrate almost any new idea." I was saddened to find that *Island Biology* is frequently little more than an attempt to marshall weak evidence behind an outdated concept of island biogeography. There is undoubtedly much truth in what Lack has said about islands, but in spite of his own intensive studies on the birds of Jamaica, support or refutation of Lack's hypotheses will be the burden of a younger generation.—ROBERT E. RICKLEFS.

Bird sounds.—Gerhard A. Thielcke. 1976. Ann Arbor, University of Michigan Press. viii+190 pp.,95 black-and-white figs. and sonagrams. Cloth. $6.95; paper $2.95.—In this work Dr. Thielcke's purpose is to provide a bridge of communication between bioacoustics and other sciences and to show the importance of avian vocalizations both as a means of communication and as a factor in evolution. Well-suited for the task,

Thielcke has broad experience in bioacoustics, especially of European passerines, and an obvious enthusiasm for the subject. The result is a readable, concise account of avian sounds and their role in the lives of birds, and one that does not overlap other recent accounts on the subject.

After an initial chapter on description and interpretation of vocalizations by sonagrams and oscillograms, Thielcke discusses the types of mechanical and vocal sounds and the anatomy and physiology of the syrinx and the avian ear. Most of the book deals with various aspects of song. Topics include: function of song, species and individual recognition of song, role of learning in song, ontogeny of song, and the role of song as an evolutionary isolating mechanism. A comprehensive chapter on types and functions of calls is noteworthy as this is a topic usually neglected in bioacoustical works. I found the discussion on sound parasitism with examples of parasitism by viduines on African grassfinches especially interesting. The book concludes with a brief discussion on the relationship between bird song and human music.

Most information for this book comes from European sources, including Thielcke's own published and unpublished works. Also no references more recent than 1968 are included, because Bird Sounds is a translation of *Vogelstimmen* (Berlin-Heidelberg-New York, Springer-Verlag), printed in 1970. Neither of these facts greatly detracts from the value of the book or its contents, as most of the principles discussed still hold true. Few typographical errors are present, and the translation from the German is good. However the bioacoustical terminology, especially in the first chapter, is confused by jargon. This is less Thielcke's fault than an indication that bioacoustics still lack universal definitions. The development of a standardized terminology would be a helpful contribution for the advancement of bioacoustical research.

Bird Sounds is an excellent buy. I recommend it to all interested in avian sounds. For the amateur, student, and scientist in nonbioacoustical fields, it will serve as an informative introduction to bird vocalizations. For students of bioacoustics, its chief value will be for its literature and insight into Thielcke's own research.—DENNIS M. FORSYTHE.

Bird hazards to aircraft.—Hans Blokpoel. 1976. Buffalo, Books Canada Inc. xiv + 236 pp., 41 figs., 4 tables, and 11 appendices. $6.50 (paper) and $10.00 (cloth).—Even though the first recorded aircraft crash and fatality caused by a bird occurred in 1912, the advent of high speed jet aircraft and a dramatic increase in the number of aircraft flying made the serious problem of bird/aircraft collisions that Blokpoel addresses in his book. His stated aim was to gather the best information available on the subject so that it could be applied to reduce significantly the hazards birds pose to aviation. In this task he has succeeded admirably, but we must wait to see if the application of the information will reduce the severity of the problem.

The book is divided into seven chapters. Chapter 1 presents general information on birds together with an overview of bird migration, local flights, flocking, and behavior of birds with respect to approaching aircraft. Most of the information will not be new to ornithologists, because this chapter was intended to provide background material for those readers unfamiliar with birds. The references for this and the other chapters are complete only through the spring of 1974, and some of the statements in this chapter are already out-of-date (e.g. birds are not sensitive to ultraviolet light, and only a few birds have a sense of smell and it is poorly developed). The use of Pettingill (1970, Ornithology in laboratory and field), Thomson (1964, A dictionary of birds), and the old edition (1966, Fundamentals of ornithology) of Van Tyne and Berger as major sources for the chapter probably accounts for this misinformation.

Chapter 2 discusses the nature of the collisions between birds and aircraft (bird strikes) and reports and analyzes bird strike statistics. Because the detection and reporting of bird strikes requires many tedious steps and voluntary cooperation for success, the statistics tend to be extremely conservative. In cases where serious strikes have occurred reports are usually filed. The data for commercial airlines are particularly hard to get for rather obvious reasons. The photographs in this chapter provide vivid illustrations of the types of damage that can result from bird strikes. The information on the costs of bird/aircraft collisions is staggering (e.g. the U.S. Air Force alone sustains an average loss of $10.9 million per year, and in 1973 the costs of repairing basic structural damage to planes from collisions with birds, not including engine damage or salaries, was $24 million). It should be stressed that these are extremely conservative cost estimates. Chapter 2 closes with an interesting survey of the bird species involved in collisions with aircraft throughout the world. The chapter effectively demonstrates the seriousness and global nature of the problem.

The emphasis of Chapter 3 is on techniques for making airplanes more resistant to bird impacts, i.e. bird-proofing the aircraft and engines. Much of the material presented in the chapter relates to the design and construction of aircraft components and should prove educational to biologists. The main airworthiness requirements regarding bird impacts are outlined with reference to turbine engines, windshields, and tail structures for both civil and military aircraft. Stricter bird strike requirements are clearly needed, but

engineering constraints argue against completely bird-proofing an aircraft. One alternative is to investigate the feasibility of using on-board devices that would disperse birds in front of the aircraft; this approach is the subject of Chapter 4. Some of the techniques investigated thus far include on-board lights, lasers, and microwaves, but apparently no effective airborne devices will be available in the near future.

The next two chapters are perhaps the most useful in the book for ornithologists who are consulted about bird/aircraft collision problems. Chapter 5 deals with the prevention of bird strikes at airports, and Chapter 6 concentrates on the prevention of bird strikes away from airports. Chapter 5 covers bird observation methods, bird dispersal methods, bird removal and killing methods, habitat manipulation, and planning of new airports. Blokpoel rightfully emphasizes that bird control at airports should ideally begin when a new airport is planned, but for existing airports scaring and habitat alteration are the most useful means of correcting a bird problem. Trapping and killing are last resort measures and often ineffective. Chapter 6 reviews the methods followed to give pilots and air traffic controllers useful information on bird hazards during flight. It stresses procedures to avoid birds in flight and discusses in detail most of the recent work on bird migration in terms of maps of routes, forecast models for intense bird migrations, and the detection, quantification, and monitoring of hazardous bird movements with radar. As with so many endeavors the quality of the data base is limiting, and this is particularly true when forecasts of bird migration must be based on weather forecasts. Despite these limitations, migration forecasts have been remarkably accurate and useful, particularly in military air operations. The discussions of radar techniques in the chapter are good, but the statement that bird heights cannot be determined reliably with surveillance radars is misleading. Modern weather surveillance radars (WSR) routinely measure the height of thunderstorms and rain showers and can successfully measure the altitudinal distribution of migrating birds.

The final chapter is only four and a half pages long and gives an overview of the national and international organizations working on the bird strike hazard; detailed information on the national groups and individuals concerned with working on bird strike problems in 1974 is in an appendix. Blokpoel says that Canada, the United States, and many European countries now have national committees that approach the bird hazard problems with varying degrees of determination and success. I find that the Inter-Agency Bird Hazard Committee of the United States operates with little determination and has accomplished so little that its success cannot be evaluated. In contrast, Canadian and European efforts have shown many achievements with marked success.

The book contains 445 references, and these are in general well chosen. Some, however, are governmental agency technical reports and hard to obtain. The organization of the text is such that any chapter may be read and understood without reading the preceding chapters. The proofreading was thorough; the text is practically free of typographical errors. Unfortunately the English system of measurement is used throughout the book, because according to Blokpoel the system is still being used widely in English-speaking countries and in aviation around the world. Nonetheless ornithologists are not accustomed to reading about Cliff Swallows weighing 0.046 lb and 6.3-oz Screech Owls. The omission of scientific names of the numerous birds, mammals, and plants mentioned in the text is particularly bothersome. Hopefully these shortcomings will be corrected in later editions.

Blokpoel is to be congratulated for compiling a great amount of scattered information on bird hazards to aircraft and presenting it in a highly readable style. The book is well worth its price and should prove useful to a wide spectrum of readers from professional ornithologists and aeronautical engineers to airport managers and air traffic controllers.—SIDNEY A. GAUTHREAUX, JR.

The Golden-cheeked Warbler.—Warren M. Pulich. 1976. Austin, Texas Parks and Wildl. Dept. xv + 172 pp. Illus. by Anne Marie Pulich. Paper. 50¢ handling charge.—A rare and threatened bird attracts particular interest among biologists and conservationists. The Golden-cheeked Warbler (*Dendroica chrysoparia*) is such a species, and this first detailed and comprehensive account of it is assured a wide and attentive audience.

The Golden-cheeked Warbler nests only in the Edwards Plateau and adjacent areas of central Texas (31 counties). Its nesting requirements are met only by dense stands of mature Ashe juniper (*Juniperus ashei*) occurring in scattered tracts known locally as cedar brakes. The bird's reliance on this tree apparently stems from nest construction with bark strips provided uniquely by mature trees of this species. It winters in a comparatively small area of montane pine-oak forest from east-central Guatemala through Honduras into northern Nicaragua. In migration it traverses Mexico, but, contrary to published accounts including the A. O. U. Check-list, it probably does not winter there. Some records of occurrence are brought into doubt by confusion with other yellow-headed warblers, particularly the Black-throated Green (*Dendroica virens*) and Hermit (*Dendroica occidentalis*).

The Golden-cheeked Warbler is not immediately in danger, but the long-range habitat trends give cause for concern. The total area covered by mature stands of Ashe juniper has shrunk 20% in little more than a decade, partly as a result of agricultural agencies' encouragement of cedar eradication to increase pasture land. Also in some places habitat has steadily deteriorated because of urban sprawl. However there has been a heartening growth of local interest in the bird, aided by Pulich, and this has led to the setting aside of several tracts of prime habitat on public and private lands.

Several circumstances invite comparison with the Kirtland's Warbler (*Dendroica kirtlandii*), which is Michigan's own bird in the same sense that this is Texas's own bird. Both are restricted during nesting season to small regions and distinctive habitats associated with one dominant kind of tree; both migrate to comparatively small winter ranges in the northern tropics, the Golden-cheeked in Central America and the Kirtland's in the Bahama Islands of the West Indies; both normally produce only one brood per year; both seem to have no specialized food requirement; and both are heavily parasitized by Brown-headed Cowbirds (*Molothrus ater*). On the other hand, there are notable differences. The habitat of the Golden-cheeked Warbler is climax forest, conferring a degree of permanence to land preserves unlike the transient forest stage occupied by the Kirtland's Warbler. The area utilized at present in Texas (about 350,000 acres) is vastly larger than that in Michigan (about 6,000 acres), and the population of the Golden-cheeked (15,000–17,000) is very much larger than that of the Kirtland's (400). The Golden-cheeked is the more difficult of the two to census, and estimates of the population have been based on appraisal of the terrain and the probable density of nesting birds in "excellent, average, and marginal" habitats; whereas, singing male Kirtland's Warblers have been counted individually.

An interesting circumstance that might pass unnoticed is that neither of these species seems to fill up the habitat available to it, although the conventional assumption is that the populations are limited by nesting habitat. Even in the most suitable spots, the occupied territories do not embrace all the space available. For example, Golden-cheeked territories have a mean size of 4.29 acres, but Pulich found only one pair per 20 acres in "excellent" habitat. Similarly, Kirtland's Warbler territories average 8.4 acres, but the density of birds in the best places is seldom greater than one pair per 30 acres.

The relationship with the cowbird is intriguing. The ratio of young Golden-cheeked Warblers fledged in Pulich's principal study group, 27% of eggs laid, was smaller than for any other species of warbler reported to date. Nearly 60% of these nests received cowbird eggs, and the other nests not entered by cowbirds produced nearly all the warblers fledged. Yet the cowbird is known to have parasitized Golden-cheeked Warblers at least as far back as the 1870s. However this account does not explore whether the cowbird has increased greatly here in modern times as in many other parts of its range. The samples in this study are not large enough to answer the question, but they arouse our curiosity. Of 15 sets of eggs Pulich collected in 1962–1964, 11 included cowbird eggs; of 15 sets an oologist collected before 1937, only 2 included cowbird eggs.

Generally the range of topics is extensive, encompassing the historical record, population, range, migration, habitat, territory, pair formation, nest building, eggs, incubation, nesting success, food habits, song, weights, and measurements. The bibliography lists not only literature cited but also collateral reading.

Pulich put tremendous effort over a period of more than 15 years into detailed searches by auto and on foot, as well as by visits to collections and libraries, to ascertain the species past and present breeding range, migratory path, and wintering ground. More than 50 pages are devoted to this phase of the study. Although not all of this will be of interest to every reader, it puts on record details that will form a base for appraising changes in the future.

The data on nesting activity and success are limited mainly to three years, 1962–1964, and the samples are small. Hopefully, as Pulich points out, others will be encouraged to do further fieldwork both on the nesting ground and on the wintering ground, where very little is known about the bird.

This report reminds us by contrast how much knowledge of most bird species has come through slow accumulation from many hands. Although Pulich graciously acknowledges many sources of help, it is apparent this work from conception through publication was mainly the product of one man and his family. He was aided in the field by his son, Warren, Jr., and the colored frontispiece and line drawings throughout the book were done by his wife.

This will remain the standard work on the Golden-cheeked Warbler for a long time, but it is not so exhaustive as to discourage study by others. This is not an easy species for research. Many parts of its range are difficult to reach, the cover is dense, the bird's song is not persistent nor does it carry far, the nests are hard to find, and the warblers are not easy to capture for marking. So it is not surprising that the samples of data are small and in some instances need considerable enlargement for refined analysis. For example, the samples of weights and measurements of birds compared from northern and southern parts of the nesting

range are often too small for calculation of useful means and standard deviations, and Pulich might have been better advised to group all examples of each sex from the entire nesting range for measurement of central tendency and variance; anyway, geographical variation in a mobile creature with such a small range would be astonishing.

No one can complain about the price of this useful book about the Golden-cheeked Warbler.—HAROLD F. MAYFIELD.

A new guide to the birds of Hong Kong.—Michael Webster, illustrated by Karen Phillipps, with additional plates by Raymond Wong, Takeshi Shiota, and Alex Olsson. 1976. Hong Kong, Sino-American Publ. Co. (114 How Ming St., Kwun Tong, Kowloon, Hong Kong). 111 pp., 8 color plates and 40 black-and-white plates. Paper. U.S. $5.95.—This volume is a very useful guide to field identification, describing concisely and illustrating well most of the 365 species of birds reliably recorded in Hong Kong as well as discussing a number of other species that are likely to occur.

The text accounts are brief, 3–12 lines per species, containing length (in inches), description and field identification including habits and often habitat, status, and seasonal presence. The descriptions are succinct and well done, giving a good picture of the bird. Their brevity, though, will preclude identifying some more difficult species, such as raptors that require more detail; e.g. the distinctive immature of *Spilornis cheela* is not mentioned.

The illustrations are accurately and attractively done. Over 350 species are illustrated, 82 in color and the rest in black and white. The species are unfortunately not identified by name on the plates, but by the species number in the text. Many of the paintings and the drawings appear to be modeled after those in other books, a procedure that is no doubt necessary in an area that lacks a good specimen collection. I am not sure how I feel about this, but perhaps the author should, at least, give credit to the artist who painted the original. Because field guide users depend heavily on the illustrations, many (especially beginners) will have trouble identifying difficult groups such as shorebirds, warblers, and flycatchers by using the line drawings. These are fine for illustrating birds with strikingly different and contrasting patterns, but do not lend themselves to showing subtle differences. Hopefully the publisher will allow more color plates in future editions; the color plates and line drawings are designed so that new color plates can simply replace the current line drawings.

The four-page introduction is a brief description of what the book is all about and gives some tips for birding. Its most useful feature is a list of good places to see birds and directions for contacting the Hong Kong Bird Watching Society. Hong Kong is one of the few places along the east coast of Asia easily accessible to bird watchers, and visitors will find this book helpful in getting acquainted with its birds.—BEN KING.

Concepts of species.—C. N. Slobodchikoff (Ed.). 1976. Vol. 3, Benchmark papers in systematic and evolutionary biology. Stroudsburg, Pennsylvania, Dowden, Hutchinson and Ross, Inc. 368 pp., illus. $25.00; **Les problèmes de l'espèce dans le règne animal.**—C. Bocquet, J. Génermont, and M. Lamotte (Eds.). Vol. 1, 1976. Mémoire no.38, Paris, Société Zool. France. 407 pp., illus. 100 French francs (about $20.00). (Can be obtained from Société Zoologique de France, 195 rue Saint Jacques, 75005 Paris, France.).—"Few biological problems have remained as consistently challenging through the past two centuries as the species problem." This sentence by Ernst Mayr opens up the volume on "The Species Problem" published in 1957 from a symposium the American Association for the Advancement of Science held in 1955. This book, which includes some very important chapters (those of Mayr, Grant, and Sonneborn in particular) on the species concept in different taxonomic groups or viewed through the lenses of various biological specialists, can surely be considered a landmark publication on this topic. Since 1957, of course, the "species problem" has been dealt with in numerous journal articles and essays, in several books on taxonomic theory and practice, and in Mayr's monumental "Animal species and evolution" (1963, abridged version 1970). This 20-year period has witnessed suggestions to use definitions of species differing in various degrees from the biological one synthesized by Mayr, and views challenging the notion that species are fundamental evolutionary units. More generally, we have lived through a period of change in the philosophical appreciation of species, speciation, evolution, systematics, and taxonomy. Yet the "species problem" is apparently not solved, for Sokal recently started an essay on this subject with the sentence: "Species present a perennial problem for biological systematics and evolutionary theory" (1974, Syst. Zool. 22: 360). The simultaneous publication of these two books might seem to confirm this view.

It must be stated at the onset that these books are utterly different in spirit, scope, and goal: they simply cannot be compared. The first, edited by Slobodchikoff, is a collection of 21 papers or chapters reprinted

from the original texts. These are gathered under five major headings, each introduced by a few pages written by Slobodchikoff himself. The second, edited by Bocquet, Génermont, and Lamotte, is the first of a three-volume treatise on the problems of species in the animal kingdom. It contains eight original essay-chapters on the species concept in various animal groups. Thus Slobodchikoff's book is a compilation, whereas the Bocquet-Génermont-Lamotte volume is a descendant of the book edited by Mayr in 1957. Each will be reviewed accordingly, and separately, below.

"Concepts of species" is volume 3 in the Benchmark series in systematic and evolutionary biology. (The previous two were both devoted to "Multivariate Statistical Methods.") Slobodchikoff makes his intentions crystal clear in his preface (p. ix): "The selections in this book were chosen primarily because they represent a point of view or illustrate the historical and philosophical development of species concepts." And further: "In making selections, I had two objectives in mind. One objective was to bring together enough material about the historical background, the philosophical bases, and the present views on species to permit critical evaluation of present species concepts within the framework of current biological theory. The other objective was to choose papers that could be used by students of systematics and evolutionary biology to expand their understanding of the problems posed by the species question." To conform with this plan, the five parts of the book are: (I) Historical and philosophical origins of species concepts; (II) Are species real?; (III) Microbial, parthenogenetic, and paleontological species; (IV) Species in higher plants and animals; and (V) Alternative concepts.

The objectives seem good, and the groupings appear logical. But a thorough examination of the chapters or papers chosen for inclusion shows that Slobodchikoff's objectives are simply not fulfilled. The "historical and philosophical development of species concepts" is offered through the distorting glass of general essays, so that every historical point of view is, at best, presented only second-hand. Furthermore, only English-speaking writers were chosen, so that the reader cannot study directly the schools of thought on species concepts dominated by other cultures and languages, especially if these concepts are recent. Thus the unwary graduate student will be led to believe that only English-speaking authors write about the species today, and will not get an inkling of the thoughts of German, French, Russian, Scandinavian, or other authors. Finally, if I consider myself a "student of systematics and evolutionary biology," how can I "expand my understanding" of the species problem when none of the essays reprinted in Slobodchikoff's book is new to me, and when I have in my personal library 10 of the 21 chapters either because I own the books (Mayr, Grant, Crowson), or I subscribe to the journals (Science, Systematic Zoology, American Naturalist), or else I have reprints of these works? For these reasons, and also because it is too expensive ($25.00), I would neither assign this book to my students if I were to teach a graduate course on the species problem nor buy the book for my own use.

"Les problèmes de l'espèce dans le règne animal" owes its origin to the centennial of the Société Zoologique de France in 1976. In view of the importance of the species as an evolutionary and systematic concept and unit, and of the lack of a general book on this topic in French since the publication of Cuénot's seminal little book of 1936 ("L'Espèce," Doin, Paris, 310 pp.), the Society sponsored a three-volume treatise on this subject. Volume I appeared in 1976, Volume II is in press, and Volume III in preparation. Chapter I of Volume I is an "Introduction to the concept of species in the animal kingdom" by Bocquet, Génermont, and Lamotte. Chapters II–IX are monographs on the species concept and problems of species in birds (II), teleost fishes (III), Lepidoptera (IV), Drosophilidae (V), mosquitoes (VI), marine crustaceans (VII), marine bivalves (VIII), and Protozoa (IX). It is a pity that no English summaries are included. Volume II will include another series of taxon-oriented chapters (including primates, rodents, gastropods, collembola, amphibians, and lizards). Volume III will contain synthetic chapters on various criteria (morphology, biometry, caryology, biochemistry, ethology), on numerical taxonomy, on the species concept in paleontology, on nomenclatural problems, and a general overview. Thus when completed, "Les problèmes de l'espèce dans le règne animal" will be a much enlarged and worthy successor to Mayr's 1957 compendium.

It would be premature to review this book on the basis of volume I alone, as the entire three-volume text will constitute a unit. Furthermore, as I authored the chapter on "The species concept in ornithology," I will say nothing about it here, but I would like to single out the chapters on Lepidoptera (Guillaumin and Descimon), on mosquitos (Grjebine, Coz, Eluard, Mouchet, and Rageau), and on Protozoa (Génermont) as outstanding. I would like also to state that the biologists who wrote chapters for volume I, unlike many of their colleagues, do not appear to consider the "species problem" as a Gordian knot in systematics, seem less concerned by problems of the definition of species, and are less annoyed by the variability in "operationality" of the biological species concept. On the other hand, they seem to accept the multiformity of kinds of species and to live not too unhappily with the difficulty of merging pure morphology with reproductive isolation. In a word, they seem quite pragmatic about the whole business of the problem of species, without for an instant

being less thoughtful or less philosophical of its implications. Much as Dobzhansky did in his essay on species of *Drosophila* (Science 1972), these biologists find "new excitement in an old field." I hope "Les problèmes de l'espèce dans le règne animal" will receive all the attention it deserves for it contains much food for thought.—FRANÇOIS VUILLEUMIER.

Atlas des Oiseaux Nicheurs de France.—Laurent Yeatman. 1976. Ministère de la Qualité de la Vie-Environnement, Paris, Société Ornithologique de France. 282 pp., maps, figs., tables. 70 French francs (obtainable from Société Ornithologique de France, 55 rue de Buffon, 75005 Paris, France).—Mapping the distribution of bird species is one of the first important steps towards delineating their geographical ranges accurately. The boundaries of their ranges can thus be delimited precisely, and the total area of distribution estimated. Furthermore, one can make statements about the continuity or discontinuity ("patchiness") in distribution and seek reasons for the observed pattern. One can also superimpose maps of the distribution of several species and estimate the density of species (in a fauna, or a group of related species, or a "guild") in relationship to topography or vegetation. In short, good maps are a precious and indispensable tool for biogeographic studies and generalizations.

But what is a good map? Probably the most important criteria for "goodness" are: (1) the entire range of the species should be included, or at least a substantial portion of it, (2) the distributional data should be based on sampling throughout the range or that portion of it being studied, and (3) the distributional data should be gathered over a very short period of time (a few years). The first criterion will insure that the map includes all or some of the actual or potential geographical variation in the ecology of the species being mapped. Secondly, the sampling guarantees that the coverage of localities is uniform and not arbitrary. And thirdly, the time limit minimizes the risk of preparing a composite map including old and recent records, and thus permits one to gauge the possibility that unusual records taken at different times are due to range expansion or contraction during that time span.

Many published maps suffer from one or more of several defects. They are usually based only on the locality records available to the worker (either museum skins or valid sight records), rarely on sampling. Distribution gaps are therefore difficult to evaluate: are they real or an artifact of lack of sampling? Such maps usually show extrapolated boundaries of distribution, which are all too easily taken as fact; this sort of datum is especially important in studies of allopatric or adjacent but not overlapping distributions. Of course the problem is how to obtain a sufficiently large number of locality records to satisfy the requirements of sampling in a minimum period of time. Clearly only a very large team or group of workers can hope to accomplish this task. This is an area of ornithology where amateurs and professionals can fruitfully collaborate, as the present Atlas testifies.

In 1969 Yeatman, then president of the Council of the Société Ornithologique de France, was inspired by the example of the British Trust for Ornithology, which was engaged in the preparation of an Atlas of Breeding Birds in Britain and Ireland. Yeatman decided that a similar effort could be carried out in France. From 1970 to 1975 amateur ornithologists censused bird distribution in France, following a set of guidelines provided by Yeatman and his immediate collaborators. For each of 1,100 rectangles of about 20×27 km these observers were to note on file cards whether each bird species was possibly, probably, or certainly breeding. The rectangle size was dictated by the availability of the maps of France, scale 1:50,000, published by the Institut Géographique National. Appendix IV, pp. 276–277, shows the base maps and rectangles.

From 1970 to 1975 a total of 1,092 of the 1,100 rectangles were actually covered in the field: only 8 (0.73%) remained totally unstudied. Thus coverage is virtually complete. Progress in coverage from 1970 to 1975 is charted in Fig. 1 (p. X) and on two maps. The one on p. 2 shows the coverage in 1970 to 1972, and reveals many gaps; the one on p. 3 shows the entire coverage from 1970 to 1975. The gaps are indeed few, but Yeatman admits (p. IX) that "not all maps [i.e. rectangles] have been equally deeply prospected"; he remarks that Sarthe, Dordogne, and Lorraine were the least well studied regions of France. These gaps, although real, can be clearly seen on the map p. 3, which thus serves as a standard of coverage against which one must compare the maps of bird distributions.

In view of the small number of contributors, and of the vast region that was surveyed in 6 years (over 500,000 square km), I think that the gaps can be considered minor, and that the distribution maps published in this Atlas can be used effectively to obtain an accurate picture of the distribution of breeding species in this part of Western Europe in the period of study. This feat is considerable. In the United Kingdom, where amateur ornithologists abound, such a collaborative effort can be accomplished on a very different scale. Between 10,000 and 15,000 persons contributed to the B.T.O. Atlas, and about 1,500 of them were major contributors (all 3,862 quadrats were covered). Yeatman achieved better than 99% coverage of 1,100 rectangles with only about 500 collaborators. Such an effort would have been unthinkable in France a

decade ago, because the hobby of bird-watching was then virtually unknown. The present Atlas thus attests to the recent development of field ornithology in France, and to the remarkable talents of Yeatman and his colleagues in the Société Ornithologique de France for having been able to enlist so efficiently the help of amateurs, in a country well known for the individualism of her inhabitants.

The bulk of the book (pp. 4–266) is devoted to the actual 264 distribution maps and an accompanying text. The format is the same throughout, and the Atlas is thus very easy to use. The text specifies the geographical and ecological aspects of distribution, indicates fluctuations in population size or range, and compares the status of each species in the period 1970–1975 and prior to 1936, when N. Mayaud published his "Inventaire des oiseaux de France." The maps show, by one of three symbols (dots of varying diameter) on each rectangle whether the species was recorded in it and if so, whether its breeding was deemed to be possible, probable, or certain (the criteria for determination of these categories are given on p. VIII). The number of maps (rectangles) where the species was noted and the percentages of each status category are also given. Thus *Podiceps cristatus* (p. 5) was recorded from 293 maps (26%), and of these, was reported as possibly breeding in 16%, probably so in 6%, and certainly in 78%.

Perusing these 264 maps one sees a number of qualitative trends in distribution. Many of them can obviously be correlated with some of France's varied topography, climate, and vegetation, including a long and ecologically varied coastline, several large rivers, estuaries, wetlands, high mountains, lowlands, Mediterranean maquis, a large peninsula (Brittany), a large island (Corsica), etc. These maps therefore give us a detailed picture of avian distribution in a large chunk of Western Europe. Careful study of them will not only be qualitative, however. As each map indicates the 1,100 rectangles, it is possible to make quantitative analyses of species diversity such as congruence of faunal limits, continent-continent, and continent-island comparisons. These analyses will lead to many questions that can be studied further in the field.

Keeping in mind the limitations of coverage carefully mentioned by Yeatman himself in the introduction, and cited in this review, and the inevitable possibility that errors have crept in either during fieldwork or during the collection of data to prepare the maps, it is nevertheless clear that the maps in this Atlas fulfill to a considerable degree the three criteria for "goodness" set forth earlier. The potential drawbacks of having used for France rather large rectangles of about 20 x 27 km, instead of small quadrats 10 x 10 km as in the British and Irish Atlas, are offset in the published presentation. Whereas each reader can, if he so wishes, carry out numerical analyses of avian distribution in France, on the sole basis of his copy of the Atlas des Oiseaux Nicheurs de France, this is virtually impossible for the U.K. without consulting the archives of the B.T.O., for the quadrats are not included on the British and Irish maps, I suppose because the scale of the maps makes it impractical to include the quadrats without making the maps almost illegible. In my view the publication of the French and of the U.K. Atlases mark the beginning of a new era in mapping avian distribution on a large scale. A European Ornithological Atlas Committee was founded in 1971, and it is hoped that a European Atlas will eventually be published. In the meantime Yeatman and the Société Ornithologique de France are to be congratulated on a fine piece of work, which was subsidized financially, it is gratifying to note, by the French Ministry of the Quality of Life and of the Environment.—FRANÇOIS VUILLEUMIER.

Bird Taxidermy.—James M. Harrison. 1976. North Pomfret, Vermont, David and Charles. xvii + 67 pp. $6.95.—A small volume on the art of taxidermy designed for the lay person. The instructions are accurate and complete with special attention given to problems caused by decomposition, slippage, and dirty skins. The illustrations are clear. The only possible problem for American readers may be some differences in terminology, especially for the materials, as this book is written for a British audience.—WALTER J. BOCK.

William Beebe. An annotated bibliography.—Tim M. Berra. 1977. Hamden, Connecticut, Archon Book (Shoe String Press). 157 pp. $15.00.—This volume, as the title indicates, is an annotated bibliography of Beebe's writings from his first article written when only 18 years old on the Brown Creeper published in 1895 to his last annual report of the Department of Tropical Research of the New York Zoological Society in 1962 shortly before his death at the age of 84. A biographical sketch and several photographs of Beebe are included. This is a very useful volume for anyone interested in the history of science and in the life of this outstanding ornithologist, zoo man, explorer, writer and naturalist.—WALTER J. BOCK.