Book Reviews

Natural Populations

Dynamics of Populations. An Advanced Study Institute, Oosterbeek, The Netherlands, Sept. 1970. P. J. DEN BOER and G. R. GRADWELL, Eds. Centre for Agricultural Publishing and Documentations, Wageningen, The Netherlands, 1971. 612 pp., illus. Dfl. 65.

This 1970 conference on the dynamics of populations of plants and animals is the heir of an illustrious 1957 symposium on animal ecology and demography (*Cold Spring Harbor Symposia on Quantitative Biology*, vol. 22). The burning question of 1957 was, "To what extent are populations 'regulated' by 'factors' that are 'independent' of the 'density' of the population?" A sterile and largely semantic controversy arose, pitting students of social birds and mammals against students of tiny beasts upon whom the weather imposes gross indignities. Although many of the studies reported at the 1970 conference were originally motivated by this controversy, the papers focus on more intriguing problems. Unfortunately, few of the speakers have stated their goals clearly enough for an audience more general than the participants in the institute.

There are 41 papers, of which 18 are highly empirical with only a few being soporific, 8 are excellent reviews of primary data published elsewhere, 6 are barely intelligible simulations of nature, 5 are seductive but immature philosophy, 2 are interesting but overly formal analytical models, and 2 stress applications to human resources. I judge at least 20 of the papers to be of higher quality than most of those currently published in the ecological journals; so I shall mention only those that most struck my fancy.

Several papers blur the traditional distinction between botany and zoology. J. L. Harper and J. White review a large literature documenting the effect of the density of plants on various phases of their life histories, which in turn influence reproduction. Critical data from plants are applied to questions that zoologists routinely ask but can answer only by inference. J. H. Connell discusses the conditions under which predators prevent competitive exclusion between species of their prey. He cites original studies of intertidal barnacles and of rain-forest trees. E. van der Meijden concurrently studied populations of the cinnabar moth and of ragwort, the moth's sole host plant.

Long-term field studies of bird populations, unheard of in 1957, are reported with a casual air that belies their novelty and difficulty. H. N. Kluyver artificially reduced the clutches of a population of great tits by about 40 percent and noted a near doubling of their subsequent adult survival. He suggests that most of the autumn mortality was socially induced rather than being due to a shortage of food. Similarly A. Watson found that winter mortality of red grouse fell heavily on those individuals who failed to secure exclusive territories during the previous autumn.

Almost every paper stresses the fact that populations and their environments are not nearly as homogeneous as current theories assume them to be. Many papers draw new insights from a study of heterogeneity per se. Qualitative changes, presumably with a genetic basis, accompanied population cycles in field mice studied by C. J. Krebs and in larch bud moths studied by W. Baltensweiler. In both cases, changes related to dispersal were adaptively correlated with the cycle, but the adaptive significance of the cycle itself remains tantalizingly obscure. A negative influence of local density on dispersal is noted or strongly inferred by S. Iwao for a population of lady beetles, by P. Gruys for the pine looper moth, and by M. J. Way and M. E. Cammell for diverse aphid species. L. C. Birch cites a variety of examples in which a heterogeneous environment provides refuges for animals in adverse seasons, whence they repeatedly colonize seasonally favorable areas. H. G. Andrewartha discusses statistical problems for sampling such populations. P. J. den Boer discusses, but unfortunately never specifies, a model in which fluctuations of density are restricted by various sorts of environmental heterogeneity. Models of populations in a heterogeneous environment should prove exciting in the near future. Data are available, and current models seem to rest on an obscure dictum by a benevolent Creator, that eggs should be put in several baskets.

The editors have done an excellent job. Misprints are scarce and trivial. Unusually concise and cogent discussions follow each paper. Appropriate papers are cross-referenced, and there is a useful index, a rarity indeed among such volumes.

Few of the authors speculate beyond their immediate work. The participants in the conference seem to have searched vainly for a monolithic synthesis rather than for a classification of the adaptive relations between the dynamics of various populations and the conditions imposed by the spatial and temporal pattern of their particular environments. In spite of, or perhaps because of, the failure to infer and to synthesize, this book should provide an excellent source for a graduate seminar on natural populations.

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Roots of Geology

The History of British Geology. A Bibliographical Study. JOHN CHALLINOR. Barnes and Noble, New York, 1972. 224 pp. $11.25.

This is a rather strange book. Its avowed purpose is "to provide a short introduction to a great and hitherto entirely neglected subject: the general history of British geology" through a bibliographic review of "works of the first importance." It may come as a surprise to others, as it did to me, to learn that the general history of geology in the science's cradle land has been so neglected. I can think of no other region for which historical studies of the science are so far advanced. Moreover, the bibliographic approach used may leave readers uneasy, for unless they know the British literature well they may not be sure how balanced the treatment is (and if they can judge this they probably do not need a book of this sort anyway). The scope is ambitious, yet the list of sources is of modest size, suggesting

inevitable subjectivity in selecting entries "of the first importance." The frequency of misspellings does not shore up one's confidence, either.

In spite of these reservations, however, I learned from the book and found upon working through it that the arrangement of material could be quite useful as an entrée to the British literature. I discovered a number of important references that were new to me. The author first presents a chronological list of 659 references on British geology dating from A.D. 1538 to 1969. Familiar ones are there, but at least a few significant items are not (Lord Kelvin's challenges to the Lyellian school, for example). A second section lists 86 "Major Themes" with a short discussion of the development of each and citations of appropriate references found in the first section. These summaries seem rather uneven, and many readers might question the particular list presented. Why not a theme on textbooks in sedimentology or in geophysics, for there are separate ones for textbooks in paleontology and in igneous petrology? But a more significant example of imbalance is provided by comparing a half-page theme on the genesis of sedimentary rocks containing no reference either to Hugh Miller's or to H. C. Sorby's writings (both men are cited elsewhere) with a theme labeled "The Malvern Hills." The latter is a one-and-one-half-page discourse on local details of the field relations of rocks and their interpretation over the years. About one-third of the themes are broadly topical ("Experimental geology," "The Ice Age," "Internal structures of rock-bodies: slaty cleavage," "Concealed geology," and so on). The other two-thirds are more geographic in nature ("The Lake District," "The geology of Scotland," and so on). Appendix A lists 79 secondary sources, each of which is identified conveniently with one or more of the Major Themes. Appendix B lists alphabetically all authors cited, with cross-referencing to the first section of the book. For many authors a sentence or two of biographical material is added, which will be helpful. Finally, appendix C contains an index of geographic, stratigraphic, and fossil names used in parts 1 and 2.

Challinor has digested an immense volume of literature into compact form that can be very useful for two groups of workers. First are those lacking any familiarity with the history of British geology; this includes many practicing geologists outside the United Kingdom. The second group of beneficiaries includes anyone seeking an introduction to the history of geologic studies of specific areas or rocks within Britain. Because much of the origin of modern geology is rooted in British rocks, this group is potentially quite large. The author has done the greatest service for this latter group.

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An Overview

Trends in General Systems Theory. GEORGE J. KLIR, Ed. Wiley-Interscience, New York, 1972. x, 462 pp., illus. $19.95.

The developing family of ideas and concepts which fall roughly under the rubric of systems theory amounts to a profound revolution in science—a revolution which will transform human thought as deeply as did the earlier ones of Galileo and Newton. The volume under review represents an attempt to provide an overview of these ideas, as they appear from present perspectives.

Unlike earlier scientific revolutions, the ideas of systems theory have not arisen within a single discipline. On the contrary, systems concepts have simultaneously arisen from a host of inter- and intradisciplinary specialties; from mathematics, computer sciences, control theory, biology, linguistics, and many of the human sciences. This diversity makes the subject multiply difficult; if the virtue of systems concepts is that they provide new and fruitful modes of unification binding together apparently unrelated sciences, the corresponding defect of that virtue is that the concepts must, at present, be extracted from a multiplicity of specialized literatures, each with its own jargon and emphasis. Moreover, it is in the nature of organized systems that they present themselves differently to different observers; the parable of the blind men and the elephant is really a parable about systems.

The volume under review seeks to circumvent these difficulties; its cumulative thrust is to exhibit what it is about systems and organizations that transcends the mass of specific structural details which inevitably accompanies any individual system, and which allows systems of utterly diverse structures to be studied in the same light. In a sense, the overall spirit and intentions are much like that of axiomatization in mathematics; once the group axioms, for example, are laid down, then immediately a host of specific mathematical structures, whatever the nature of their elements, can be seen as representations or realizations of a common abstract system. In this way, a theorem about abstract groups simultaneously reaches into all branches of mathematics and allows information from any one part of mathematics to be transferred into all the other parts. In the same way, the study of the essence of organization and control, which is the concern of systems theory, touches every branch of science and enables us to formulate laws and principles which illuminate many apparently unrelated fields.

At the present time, systems theory is in an exceedingly exciting, dynamical phase of growth. No book can hope fully to capture this dynamism; at best it can offer us a snapshot exhibiting how the field appears at a particular instant of time. Indeed, the volume under review offers us a series of such snapshots, each taken from a rather different angle. But just as with an ordinary photograph, each such snapshot inevitably involves distortions of perspective and leaves even very large and important structures hidden behind smaller but more proximate ones. The multiplicity of snapshots helps correct for such problems, but cannot in the present nature of things eliminate them. Thus anyone involved with systems will inevitably have some quarrels over choice and emphasis of materials. To specify a few of mine: (i) biology and linguistics, which have introduced a host of profound ideas into systems theory, are rather badly scouted; (ii) in several long discussions of systems analogies, the mechano-optical analogy of Hamilton (which until now is by far the most important) is not even mentioned; (iii) the final chapter, on extended topology, though most interesting in itself, is only minimally related to the main thrust of the book; (iv) problems of systems epistemology and alternate modes of system description are hardly touched on.

Nevertheless, there is much to praise in this book. The bibliographies alone are of enormous value in a subject as far flung as systems theory. The individual contributions are in the main well chosen, with many truly excellent expository discussions (particularly by Löfgren, Rapoport, Weinberg, and von