

## BOOK REVIEWS

BEVERTON, RAYMOND J. H., AND SIDNEY J. HOLT. 1957. *On the Dynamics of Exploited Fish Populations*. Gt. Britain, Fishery Invest., Ser. II, Vol. XIX. 533 pp. 126/— (= U. S. \$17.64).

It is brash to attempt to review in short compass a 533-page book which the authors have themselves required 8 pages to summarize. I have met both authors, and Sidney Holt was our biometrics instructor in a six-weeks FAO course which I conducted in Istanbul in 1953. They have done a truly stupendous and painstaking job in producing a monograph on population dynamics which will enhance the meaning of fishery dynamics for a long period. It should prove equally useful to biometricians studying other organisms.

Any comments which I make in the invidious role of a critic are not meant to detract from the value of a work that belongs on the shelf of any serious student of the subject. For the average biologist the very multiplicity of formulae—the count is 419 formally numbered formulae plus divers minor formulae—is too formidable to cope with. The number of formulae is further complicated by radical departure from the simplicity of R. A. Fisher. The authors list 120 different symbols, 12 of which are used with two meanings and 2 with three meanings. The extensive references throughout the text to previous sections of the book makes reading laborious.

The classical approach in fisheries has been from the actual to the theoretical. The authors have reversed this at times using a highly theoretical and purely mathematical approach. It is too soon to form a competent judgment of the results. For demersal fisheries the authors have been able in many instances to find data which support their formulae. It must here be pointed out, however, that some of the assumptions which apply to these relatively simple cases may often fail when applied to pelagic or anadromous species.

The chief shortcoming of the theoretical approach is the necessity for always making a number of assumptions. Only rarely does one find all of these assumptions satisfied in any set of actual field data. Granted that theory may sometimes enable revision of data collecting methods so as to satisfy some assumption, yet the biologist must make decisions now based on the data available.

The case which the authors attempt to make for "permanent self-induced oscillations in population abundance" (p. 57) for populations with a dome-shaped reproductive curve having a steep right limb, while possibly mathematically sound, must be based on a stable environment. Since such an environment is practically non-existent the correctness of this theory must await corroboration.

The authors were evidently unaware of the occasional deaths of millions of marine fish in the Laguna Madre of Texas reported by Gunter,

Hedgpeth and others (footnote on p. 68), from excessively high salinities.

In developing the formulae for fishing mortality (pp. 89-91) the assumption is made that by taking a small enough unit of time the natural mortality occurring simultaneously can be ignored. This could as well be stated in reverse.

Owing undoubtedly to the authors familiarity with year-round demersal fisheries the sections on gear saturation and seasonal variation in fishing (pp. 94-95) are disappointingly brief and offer no adequate solutions for analyzing the types of data usually available for determining abundance in anadromous and many pelagic fisheries.

In developing methods for standardizing fishing effort the authors claim a linear fit between gross tonnage and the power factor of trawlers; yet the linear curves shown (p. 175) should obviously be curvilinear. The reverse is true of the length versus power factor curve on p. 176. This effort to use only proportional linear curves is understandable since it permits easier use of the British trawl statistics which give hours of trawling per gross ton-hour. However, there is little mention of age of vessels, an important factor of gear efficiency in many fisheries.

In selecting examples to illustrate the derivation of the natural mortality coefficient the authors chose data from the Fraser River sockeye fisheries [Rounsefell, 1949. *Biometrics*, 5(2)]. Unfortunately, the coefficient which they ascribe to "residual fishing during the period as well as true natural mortality" does not contain natural mortality. The escapement of salmon in the example was derived from the gillnet catches assuming the absence of natural mortality. The very high coefficient they show is due entirely to fishing by other gears.

In discussing the relation between potential egg production and recruitment the authors have used throughout the text a curve approaching an upper asymptote. They cite a few examples to show that this type of reproductive curve not only applies to marine fishes but also applies to salmon. They thus dismiss the theoretical interpretation of a dome-shaped reproductive curve for salmon as postulated by Ricker [1954. *Stock and Recruitment*. J. Fish. Res. Bd. Canada, 11(5)]. In the only example for salmon containing over 7 years of data the authors used the Fraser River sockeye, the runs of which are composed of several distinct races that merely use the river as a means of ingress and egress from their individual lake systems. Full confirmation of Ricker's hypothesis has since been shown using 59 years of data for the Karluk River sockeye [Rounsefell, 1958. *Bull. U. S. Fish and Wildlife Service*, 58(130)].

The use of multitudinous symbols with tiny subscripts makes use of a reading lens almost necessary. No distinction is clearly made between formulae that have been corroborated by adequate field data and those which are purely theoretical concepts. Perhaps the most noticeable omission is the failure to include tests of significance.

MOORE, HILARY B. 1958. **Marine Ecology.** John Wiley & Sons, Inc., New York. 493 pp. \$9.50.

Oceanography embraces study of all aspects of the sea. Marine ecology, the science of interrelations between living marine organisms and their environment, draws upon several branches of oceanography (for environmental factors) and in addition includes study of individuals and species (autecology) and—the unique aspect of the science—of groups of marine organisms associated together as populations, communities, and ecosystems (synecology). The magnitude of the task of synthesis of knowledge in marine ecology in the form of a text for student use is indicated by the substantial three dimensional geographic domain encompassed by, the large number and complexity of interrelated functional units in, and the incompleteness of knowledge in many areas of the field.

Such a text has been attempted by Hilary B. Moore in *Marine Ecology*. The author expresses his concept of ecology and describes the content of his book as follows (p. 16): "A survey of the present status of ecological knowledge cannot be made to fit into a concise and orderly pattern and would, in fact, suffer if so limited. There is too much interconnection of effects. In succeeding chapters, the various ecological factors are considered in turn, and examples are given of the ways in which they have been found to affect different organisms. After this an account is given of the more important types of environment, together with an outline of the variations and significance of the various factors in each. These environments range from the comparatively stable and simple abyssal regions to the highly complex intertidal zone. Finally, these same environments are considered in terms of the organisms inhabiting them with a discussion of the present status of knowledge of typical forms."

The book possesses an attractive format and is enhanced by 214 illustrations and 71 tables. It contains 26 pages of references, principally in English (the choice was deliberate to meet needs of English-speaking students), which represent a wide search of the literature. The text introduces a classification of plants and animals designed to facilitate the placing of unfamiliar genera in appropriate taxa. This is helpful since the author draws examples from marine areas over many different parts of the earth.

The volume strongly stresses environmental

In summary, this book is a veritable gold mine of information for biometricians interested in population dynamics. Although the reviewer may disagree on a few points, this in nowise detracts from the overall value of this exhaustive treatise.

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ecology, autecology, and habitat ecology. Eighty-two pages provide good coverage of physical and chemical environmental factors. The next 24 pages are devoted to "biological environmental factors" and cover the topics: food, crowding, dispersal, predation, and interaction of multiple factors. The subject of "dispersal," however, does not fit smoothly in a framework of "biological environmental factors." A description of major habitats occupies the following 81 pages. Penetration of light in the upper oceanic zone is well treated, but discussion of the physical characteristics of estuaries conspicuously omits such aspects of circulation as non-tidal flow and the significance of this to planktonic larvae of estuarine organisms. A lengthy explanation (pp. 195-8) on the "effect of . . . salinity distribution on the variations in optimum levels of various types of organisms in an estuary" is not clear. Two pages of discussion of pollution (the only treatment of the subject in the text) are appended to the section on salinity in the estuary; since pollution is not restricted to estuaries, it might better be treated in a separate section. In view of the significance of salt marshes and mangroves, it is unfortunate that so little space is devoted to their habitats. The next 204 pages cover organisms by habitats. The best sections are those on organisms of the upper oceanic zone, coral reefs, and intertidal rocky shores. That on organisms of intertidal rocky shores is disproportionately long, which probably reflects accessibility and more active study of this marine area. The section on inshore pelagic organisms devotes 22 pages to the ecology (much of it more conservation than ecology) of commercial inshore fin fisheries; by contrast the section on sublittoral "bottom communities" reviews briefly principally Petersen's bottom community studies and entirely omits review of and reference to the substantial ecological literature on the various species of commercial oysters. Likewise no consideration is given to dominant forms like *Calinectes* which are equally active on the bottom and in the water. Combination of the sections on major habitats and organisms would have eliminated some duplication.

The book closes with a chapter of 8 pages entitled "Review." The author points out here (as well as in the "Introduction") that ". . . in the whole field of ecology, there are very few

general laws or principles that have been enunciated." One wonders, then, of the effectiveness of the labors of W. C. Allee, A. E. Emerson, O. Park, T. Park, and K. P. Schmidt in their monumental *Principles of Animal Ecology* (1949), of G. L. Clarke in his *Elements of Ecology* (1954), and of E. P. Odum and H. T. Odum in *Fundamentals of Ecology* (1959)—just to mention a few of the contributions on the synthesis of ecological principles. The author states that of the principles which are generally accepted, some are of only limited application and others do not apply to marine forms. In this connection this reviewer would like to point out that no aspect of marine ecology has been investigated exhaustively enough to demonstrate whether ecological principles enunciated in connection with terrestrial or fresh water do not apply. The author also suggests (p. 419) that the community (discussion of which is omitted throughout most of the text) "may be something more than the sum of its constituents," since "factors controlling the community differ from those controlling individual species" (?); and that "when the autecologist knows the characteristics of all the possible replacement units" (alternative species or physiological races which may be substituted to meet changing conditions) "in a given community, then he will know all the possible manifestations of that community." This possibility appears incongruous with the concept expressed by many ecologists that a biotic community has characteristics additional to its individual and population components.

According to the author ecology during its evolution has tended to concentrate on two approaches—autecology (where the species is the unit) and synecology (where the community is the unit). He suggests that "a rift has developed between the two schools of thought, and the protagonists of one sometimes fail to appreciate the true value of the other" (p. 7). He recommends that a third approach (which he terms "integral ecology") recombine autecology and synecology into the original whole. Actually, however, there are no sharp boundaries between autecology and synecology: these concepts simply represent two ways of approaching ecological problems. The book suffers occasionally from inadequate definition of terms introduced by the author and lack of integration of these with ecological terms in more common usage in the literature. For example, one wonders if the author's use of "integral ecology" is synonymous with the current use of "ecosystem"?

It is regrettable that the text gives evidence of inadequate editing and hasty preparation. A superficial count disclosed some 15 conspicuous typographical errors. Four of these concerned misspelling of authors' names. A reference to Tressler (1951) is cited in the text (p. 362) but no such reference is listed under the section on "References"; likewise the year of publication to a reference by Orr and Moorhouse (p. 52) is

omitted. On page one it is stated that a *Treatise on Marine Ecology and Palaeoecology* will be published, and later (p. vi) that the *Treatise* has been published. The author uses the terms "tropism" and "taxis" interchangeably, yet refers to Fraenkel and Gunn *The Orientation of Animals* (1940) in which tropism is used to refer to orientation of sessile organisms, and taxis to that of motile organisms. The eastern American oyster is now in the genus *Crassostrea* rather than *Ostrea* (p. 28). The contribution to marine ecology of the effect of temperature on grasshopper eggs (p. 32) is questionable. On p. 245 the statement is made that nannoplankton have proved to be an ideal food for such species as oyster larvae and *Calanus*; recent researches, however, show at least for the oyster that only certain species provide good food. On p. 117 the author notes (without citation) that the shape of the hole bored by carnivorous gastropods is frequently characteristic of a particular species of gastropod (to my knowledge available research is insufficient to permit his generalization). No reference is given to the interesting possibility (p. 309) that "clam beds in North America (*Venus mercenaria*), which have declined in value through lack of settlement of spat, may often be recolonized when soil is spread over the surface . . ." (this refers to investigations of *Mya*, not *Venus*); or that "food material contained in the larvae which disappear by predation is not wholly lost to the parent species, since many of the parents have been recorded as feeding to a considerable extent on their own young when these are ready to settle" (p. 315). And on another page (p. 375-6) the author states that "Boring of the *Mytilus* shells, by *Purpura*, is performed entirely by radula action, without the assistance of any acid secretion." (It would be interesting to see the evidence for this in view of research appearing during the last two decades on boring mechanisms in muricid and naticid gastropods).

The reviewer found the book difficult reading, principally because more care was not exercised by the author in phrasing sentences; for example: "It is also known that many of the species composing this deep layer, in the region where it has been demonstrated, are very wide distribution elsewhere" (p. 223); and "Marshall and Orr (1931) found a surprising ability to remove sediment from the surface of the coral" (p. 329).

This volume, although entitled "Marine Ecology," makes only passing mention of, or omits entirely, such significant areas of marine ecology as species population, interspecies populations, communities, and ecosystems. It is difficult to agree with the author (p. 412) that "in the present state of our knowledge, attempts to regiment ecological observations into a set pattern have too often resulted in obscuring vitally important points"; and it is not out of place to suggest that he has, in fact, regimented

the results of his many years of research and his wide coverage of the marine ecological literature into the specific patterns which he formulated for his book. In the review, study, and synthesis leading to the preparation of his book, the author placed himself in an unusually favorable position to attempt application of the principles of general ecology to marine ecology and to formulate new concepts; it is disappointing that more of this was not done.

Although prepared by the author for student use, this text does not lend itself to use in introductory courses in marine ecology, principally because of the imbalance of the subject matter of the book, the presence in it of numerous typographical errors, and evidence of hasty prepara-

tion. It should, however, prove useful to investigators in the field of marine ecology as a reference volume. In view of accelerated research and increased course offerings in marine ecology, there is an urgent need for a well balanced textbook in this branch of oceanography written for upper undergraduate students at the college and university level. Perhaps Professor Moore would be willing to revise his book to fill this need.

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