

is included. An extensive discussion of the disadvantages of the ^{14}C method is given, but no discussion of the ^{14}C method itself is provided, or of its advantages (there must surely be some of these!). Although some freshwater work is cited when pertinent (e.g., the work of Overbeck and Fogg), no reference is given to the freshwater work of Kuznetsov, Sorokin, or Goldman, all of considerable pertinence for marine microbiologists. The work of Watson on nitrification and nitrifying bacteria in the sea is not cited, although Watson is referred to obliquely as "others" (p. 141).

Since this book appears about two years after the previous one, it is relevant to ask how much of the recent literature is discussed. There are no 1967 references and only two from 1966—both of the author. There are 23 references from 1965 or about 5% of the total. Although dated 1967, this book must have been in the publisher's mill for over a year after it was written. Thus the publisher's blurb on the dust jacket: "Much of the material discussed in the ecological section has been published within the last two years" seems inaccurate at best. Indeed, much of the material discussed *in extenso* in the previous book is again discussed *in extenso* in this one.

There are three chapters on applied marine microbiology: one on the role of microorganisms in marine fouling, one on fish spoilage, and one on geobiology. Although the latter appropriately cites the work of ZoBell and of Baas-Becking (all pre-1960), the extensive Russian work is not mentioned.

There are many minor points with which I could quibble. For instance, 1) a pH/Eh diagram is referred to as a description of the sulfur cycle (p. 270); 2) viable counts for bacteria are belittled (p. 21, p. 146) and then used extensively in the discussion of fish spoilage (Table XIII); 3) the growth rate of a diatom is calculated from the net increase in cell number in a water mass (p. 170), whereas on p. 172 it is stated that "the microorganisms which we count . . . are . . . the residue from grazing"; 4) it is stated that diatoms obtain their iron from particles rather than from soluble organic complexes (p. 102–103); if this has been shown to be true experimentally, then at least a reference to the work should have been given; 5) it is implied that diatoms do not have a storage polysaccharide (p. 98) whereas in fact, Meeuse has shown that they form β -1,3-glucan; 6) it is stated (p. 80) that radiant energy used in cyclic phosphorylation cannot be used in the assimilation of carbon dioxide whereas, in fact, this is precisely how the Athiorhodaceae make a living; 7) it is stated (p. 79) that many oceanographers are not aware that many algae have growth factor requirements, whereas surely by now, only in the farthest reaches of the earth have the oceanographers escaped Provasoli's message! 8) a bacterium is hardly "aerobic in nutrition" (p. 44); 9) pure cultures of bacteria do not

vary in morphology and biochemistry in a willy-nilly fashion (p. 41–42); generations of bacterial geneticists have been able to obtain meaningful results precisely because pure cultures do not vary; 10) the kind of filter used by microbiologists is a *membrane* filter rather than a molecular filter (p. 23); 11) it is stated that the marine microbiologist has to consider simultaneously more factors than any other microbial ecologist (p. 13); in fact, no marine microbiologist has ever studied his habitat with the completeness of the limnologist; 12) red tides do not occur only in the sea (p. 12); in fact, an equivalent phenomenon occurs in Lago di Tovel in Italy.

The illustrations are unexciting at best. Figure 8 should be an embarrassment to both the author and the photographer.

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GOLDMAN, C. R. [ED.]. 1966. **Primary Productivity in Aquatic Environments.** Univ. Calif. Press, Berkeley. 464 p. \$7.00.

This volume is one of the results of the first symposium held by the International Biological Program. It is chiefly concerned with the measurement and evaluation of rates of photosynthetic production in natural aquatic communities. The book contains 23 papers and three abstracts, grouped into six major divisions. It starts with a review of the biochemistry of photosynthesis and proceeds with papers on the effect of nutrition, on production and use of organic dissolved materials, higher plants, periphyton, and relations with standing crop.

The grouping seems somewhat arbitrary, largely because some of the papers are complexly organized themselves and deal with more than one kind of problem and partly because some are not easily categorized. The volume, then, is not to be regarded as a highly organized, textlike presentation of the subject, but to be a series of independent reviews and presentations of new data. The volume can be regarded as a record of what a number of the major leaders of the field think is important now, and that makes the volume required reading for all limnologists and marine biologists.

The most useful papers are those which take the trouble to assemble scattered literature or which present in some detail information not available before. It would be unjust to single out only a few papers for special mention, for there are more useful ones than can be listed here. There are some unfortunate pages, with correlations evaluated neither for significance nor mechanism, or with poorly defined concepts, but such material is relatively scarce in the book.

For too long, there has been a large gap be-

tween the developments in this field and those in biochemistry and plant physiology. On the evidence of this volume, the gap is being closed, but a great deal of work and thinking remains to be done that will connect the observations and theory of the behavior of natural populations in their normal light and nutrient environment with the physiological mechanisms. Perhaps the existence of this book will help close the gap further, although only a few of the authors have clearly defined any problems or fields for future work. Very few of the authors appear to be thinking of problems of community organization and general productivity; perhaps the focus of the symposium would take emphasis off such considerations, but a good many of the control processes discussed in detail operate as part of a continuous system. The symposium was originally issued from the Istituto di Idrobiologia in Pallanza, and is now made available in larger numbers by this reprinting.

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NICOL, J. A. C. 1967. **The Biology of Marine Animals, 2nd Ed.** Wiley and Sons, New York. 699 p. \$15.95.

A vast quantity of information on the comparative physiology of marine organisms is packed between the covers of Dr. Nicol's book. In spite of its slightly misleading title, one only catches glimpses of the whole animal, although where they do occur, they add an engaging and informative perspective on the adaptive significance of such phenomena as bioluminescence and color changes. Biological oceanographers will find the sections on respiration, nutrition and feeding mechanisms, sensory organs and receptors, and luminescence to be particularly useful. Marine biologists, on the other hand, if the distinction is at all warranted, will be disappointed in the section on digestion, since no mention is made of the ecologically important concepts of assimilation and food value. Both biologist and oceanographer alike will find the book to be a valuable entrée to the physiology of marine animals.

This second edition has been reworked by Dr. Nicol, and although many of the changes are subtle, they do effectively update the text. For instance, there is somewhat more on osmotic adjustment; the section on feeding mechanisms has been improved; phylogenetic speculations on the distribution of phosphagens have been deleted; new research on flotation mechanisms in invertebrates is added; and so on. The most obvious change is in the texture of the paper. By use of a glossy, high-contrast paper, a high standard in the clarity of all the line drawings and figures, especially the many kymograph tracings, has been achieved. In general, this text is

admirably suited to the needs of graduate students and others wishing to expand their understanding of marine organisms.

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MAITLAND, P. S. 1966. **Studies on Loch Lomond 2. The Fauna of the River Endrick.** Univ. Glasgow, Blackie and Son, Glasgow. 194 p. 27s.

This is the second volume of a series devoted to biological studies of Loch Lomond, the first of which contained several papers on the lake itself. The River Endrick is a major tributary of Loch Lomond, and it has for several years been under intensive study by Dr. Maitland. This book is partly a summary of previously published work and partly a progress report on continuing studies. It is one of the few existing attempts available to ecologists to bring together between two covers most of what is known about one river system.

The treatment is definitely biased towards the zoological interests of the author, but a chapter is devoted to the geology, topography, land use, climate, and flora of the river (the algae are notably missing from this last section).

About half the book is devoted to the invertebrate benthos, of which qualitative collections were made at intervals at 12 points along the river. The occurrence of each species is discussed in relation to macro- and micro-habitat, and it should here be emphasized that this type of study can be carried a long way in Britain because of the limited and well-known fauna. The main biotopes are then discussed in relation to the percentage composition of their fauna, and this is followed by a quantitative study of the fauna at three selected stations. This section includes a discussion of the problems of sampling stream benthos and the importance of mesh size where sieves have to be used in sorting. It is concluded that spates, which fortunately for American readers are defined, are an important factor in the control of the numbers of the benthos.

The fishes are listed, as are the birds and mammals of the valley, and data are given and discussed on the populations, food, and growth rates of five species of fishes.

The last two chapters deal with the influence of man on the valley and some general features of the biology of the main river. Human influence is clearly considerable, although this is not immediately obvious, and there is little pollution. Organic pollution is, however, detectable by biological methods at several points and the results of several surveys of the macrobenthos illustrate this. It is also shown that the composition of the fauna at various points along the length of the river does not fit into any of the rather rigid