as major influences on mental maps.

One similarly misses, in this single-minded devotion to the domain of cognition, any concern for the motivational or affective side of the problem. The thinking of Kevin Lynch, whose book *The Image of the City* (*4*) is one of the early landmarks in this field and whose influence is acknowledged throughout this volume, was refreshingly free from this limitation, for Lynch made much of the role of "imageability" in leading to a sense of satisfaction, of well-being, of affective investment in one's environment. But of that there is no trace to be found in this volume, just as the notion of "imageability" as a characteristic of particular urban forms, rather than of the cognizer, is left largely untouched, except for one comparative study of mental maps of Milan and Rome, by Donata Francescato and William Mebane.

In conclusion, let me emphasize that these several criticisms, if such they be, are criticisms of the field introduced to the world at large via this book, rather than of the editors. For their work Downs and Stea deserve nothing but praise. Their volume is an evident labor of love, such as is found all too rarely in edited works of this type. They have not only struck a most effective balance between reports of research, literature reviews, and theoretical papers, and shown admirable judgment and a sense of the dimensions of the field in their selections, but have gone to some lengths to ensure adequate representation of the major approaches and aspects of the field, in a number of cases by specifically soliciting papers on particular subjects from their authors. Their own contributions, in the form of an introductory chapter and shorter commentaries prefacing the various sections, are far from perfunctory and are in fact most helpful. One suspects, too, that the general high level of readability of the contributions owes much to their editorial efforts. Finally, their publishers have served them well on the production end. This is, in short, a volume to which those in the growing field of environment-and-behavior will turn frequently, as much from necessity as for enjoyment and profit.

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Acoustics and Fisheries

The Detection of Fish. DAVID CUSHING. Pergamon, New York, 1973. xiv, 200 pp., illus. $16.50. International Series of Monographs in Pure and Applied Biology: Zoology, vol. 52.

The author's primary purpose is to treat the use of echo-sounding techniques in the study of fisheries problems. Particular emphasis is given to estimation of abundance of stocks and open sea studies of fish behavior. The scope is thus somewhat narrower than the title implies, although the introductory material includes brief discussions of fish detection by means other than active echo-ranging. In the light of present fisheries technology this is probably logical, although there has been much reliance on fish detection from aircraft, and in earlier, quieter times fish could be detected passively simply by listening through the hull of one's boat. The noisiest fish, however, do not constitute the resources represented by the cod, herring, hake, and tuna which are logically the book's principal concerns.

Underwater acoustic system capabilities moved forward greatly during World War II in response to the need to find submarines in an environment that cannot be penetrated effectively by electromagnetic radiation (optical or radar systems). The resulting technology and subsequent Navy-oriented developments have been used in limited fashion over the ensuing 30 years in both biological and geological oceanography and the related applied fields of fisheries and mineral exploration. This book assembles an account of these applications and their results in the fisheries context, pulling together material previously available only in widely scattered journals.

It conveys the flavor of the sea in its descriptions of specific fisheries in various parts of the world and indirectly demonstrates some of the attributes of successful interaction among the scientists, engineers, and fishermen who work under often difficult conditions. This latter aspect appears, for example, in the requirement to work with any system of units with which a particular group is comfortable—the figures (all taken from previous papers and reports) may show lengths in meters, fathoms, nautical miles, or cables (0.1 nautical mile) while catches are given in pounds, tons, milliliters, and crans (0.182 ton). The sections on elements of underwater acoustics and data processing are not exhaustive but provide an appropriate background for understanding experiments carried out by means of echo-sounder techniques.

There is growing activity in this field, involving more sophisticated research equipment and data analysis techniques. This is sure to continue, with applied objectives expanding beyond the limited questions of optimal management of existing individual fisheries to biological indications of ocean pollution and the full range of interactions between the fisheries and their environment. In this context, this book will find its greatest use in providing beginners with a good reference foundation, consolidating most of the work done in the 1950's and 1960's.

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Reef Research

Biology and Geology of Coral Reefs. O. A. JONES and R. ENDEAN, Eds. Vol. 1, Geology 1. xviii, 410 pp., illus. + maps. $28. Vol. 2, Biology 1. xxii, 480 pp., illus. $42.50. Academic Press, New York, 1973.

The past 20 years have seen a great revival of research on living and fossil coral reefs by biologists and geologists, partly stimulated, perhaps, by the seemingly sudden destructive eruptions on many living reefs of the Indo-Pacific by the previously apparently rare "crown of thorns" starfish *Acanthaster*. Three years ago saw the publication of a fat volume of papers on the reefs of the Indian Ocean, two years ago there appeared a symposium volume on corals and coral reefs, and now we have two volumes (with two more to come), dedicated appropriately to the Great Barrier Reef Committee, that set out to present "in one source as many as possible of the major advances made in

the diverse facets of coral reef problems, advances scattered in a multitude of papers." The success of this encapsulation will be judged better when the third and fourth volumes, containing the rest of the 46 chapters by nearly as many authors, are published, but the contents of these first two bode well.

The papers, as the introduction implies, are essentially reviews, though most of them contain previously unpublished material. Brief notices will give some idea of the scope and contents. Volume 1, Geology 1, opens with 50 pages on Caribbean reefs by J. D. Milliman, a concise analysis with references to nearly everything that has been written this century. D. R. Stoddart equally well covers the reefs of the Indian Ocean. A short article by H. S. Ladd neatly summarizes the results and implications of the extensive geological studies of Bikini and Eniwetok atolls (Marshall Islands). J. P. Chevalier surveys the work in the past few years on the reefs of French Polynesia and the recent studies in New Caledonia. The late F. W. Whitehouse has contributed, in his easy style, a description of the little-known reefs of the New Guinea–Torres Strait region.

The remaining five papers in volume 1 concentrate on the Great Barrier Reefs. All the authors seem to recognize that this vast province is not a single reef, but balk at using the label "Great Barrier Reefs" first given it 170 years ago by Matthew Flinders. D. E. Brandon sets the scene with many new data on the oceanography of the reef area, followed by a presentation of the geomorphic setting by W. G. H. Maxwell, including an important summary of the results of recent deep drilling. The account of the structure and tectonics of northeastern Queensland and their relation to the reefs by E. Heidecker is marred by five almost incomprehensible physiographic diagrams. The complex problem of sediment accumulation is considered by Maxwell, using distribution maps derived from his *Atlas of the Great Barrier Reef*, which here suffer from reduction and poor reproduction. A. R. Lloyd gives the results of his study of the Foraminifera from four bore holes, one, at the north end of the reefs, reaching nearly 12,000 feet into the Jurassic. A large foldout in the back of the volume is so arranged that one cannot look at any of the 12 maps and refer at the same time to the text.

Volume 2, Biology 1, proffers 12 papers on developments in old and new fields of coral reef biology. L. H. Di Salvo discusses microogranisms in reef waters and sediments and their involvement in reef carbonate dynamics, an aspect previously little studied. Following this a chapter by Yu. I. Sorokin considers the microbiological aspects of the productivity of reefs, demonstrating the metabolic and biosynthetic role of microorganisms in this ecosystem. L. Muscatine very ably summarizes the present status of the old problem of nutrition in corals. P. R. Burckholder contributes a highly interesting review, with new data, of the ecology of marine antibiotics and reefs, from bacteria to chordates. L. S. Cierеszko and T. K. B. Karns note in their article on the biochemistry of reef coelenterates that these organisms afford "a mine for novel compounds of potential value as drugs or as tools for pharmacological research." J. H. Connell surveys work on the population ecology of hermatypic corals, including his own extensive studies at Heron Island, and new data on variation in reef communities at Heron Island are described by J. F. Grassle. P. W. Glynn's account of aspects of reef ecology in the western Atlantic region packs into some 50 pages a surprising amount of information on work done and in progress. G. J. Bakus summarizes what is known of the biology and ecology of tropical holothurians and reveals how much is yet to be learned about these quaint and significant reef inhabitants. One of the parameters of the "*Acanthaster* problem," the early life history of these and other asteroids, is considered by M. Yamaguchi, mainly from his own recent research. The final paper, by R. Endean, long deeply involved in the same "problem," is a balanced review of present knowledge of the population explosions of *Acanthaster* and their destructive effects on Indo-Pacific reefs, although not everyone may agree with Endean's suggestion that these eruptions may have a human causation.

Both volumes are well printed, with few obvious typographical errors, although some authors still believe that "fauna" is plural and "data" is singular. The references for each article are exhaustive, and each volume has indexes of authors (about 350 in Geology 1) and subjects plus an index to localities in Geology 1 and a systematic index in Biology 1. Many halftone illustrations, especially where five or six reef views are crowded on one page, suffer from too much reduction and muddiness.

The editors have done well. Their efforts will be appreciated by all hermatologists, hermatophiles, and others concerned with the kaleidoscopic complex of coral reefs. These readers will be looking forward to the last two volumes, although the present ones contain no clues as to their contents.

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Structures in an Aqueous World

The Hydrophobic Effect. Formation of Micelles and Biological Membranes. CHARLES TANFORD. Wiley-Interscience, New York, 1973. viii, 200 pp., illus. $12.50.

Charles Tanford has performed a valuable service for many species of biologists and biochemists in writing this book. It contains in concise (in fact, almost spartan) form the fundamental physicochemical information anyone with a serious research interest in membranes or related organized systems must have in order to work and think intelligently in the field. Unfortunately many membranologists are not aware of the basics outlined here, which is understandable since these basics have never before, to my knowledge, been presented so clearly and directly within a single short volume. I would hope that all laboratories engaged in membrane research will purchase the book, for it is admirably suited to serve as a reference standard on which molecular hypotheses of the structure and stability of membranes (and of all other macromolecular systems which are at least partially stabilized by hydrophobic interactions) can be constructed. This would go far toward assuring that everyone begins with the same physicochemical understanding, and the same semantics.

The book opens with chapters on the thermodynamics of the solubility of hydrocarbons in water and then moves to an equivalent consideration of the solubility of amphiphiles in water and organic solvents. An amphiphile is defined as a molecule containing a polar ("sympathetic" to water) and a nonpolar ("antipathetic" to water) end. As Tanford clearly states, it is the existence of such amphiphilic molecules,