



A Marine Biology Symposium

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Ecology, Vol. 40, No. 4. (Oct., 1959), pp. 745-746.

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example, the chapter on lunar periodicity was completed before publication of the thought-provoking paper by LaMont Cole on the matter of periodicity, which is not considered in this volume. Dr. Hedgpeth failed to realize (p. 45) that some successions of marine communities described by this reviewer were physiographic successions rather than biotic successions, and that those communities were in areas on the verge of being cut off from the ocean rather than typical oceanic habitats. The use of the expression "adult community" by Dr. Thorson (p. 471) rather than the more common expression "climax community" seems to be unnecessary. In the chapter on "Interrelations of Organisms" it is surprising that predation is not considered. The range of *Limulus* is not given accurately in the chapter by Gordon Gunter (p. 173). Actually *L. polyphemus* extends far northward beyond Cape Cod as a common animal.

Typographical errors are not unduly numerous considering the magnitude of this volume, and every writer knows the difficulty of producing published work without such errors. Most of those noted in this work are of little importance, but a few are regrettable. For example, the names of three authors are misspelled in the Table of Contents, and the death of Karl P. Schmidt is reported (p. 1213) as occurring four years before it actually occurred. There are a number of minor typographic errors, and some instances where taxonomic names are incorrect. The eel is referred to as an anadromous fish

rather than as a catadromous species (p. 795). Such errors are rarely of consequence, but it is unfortunate that a number of errors appear in the bibliographies which may very well be copied and hence perpetuated for years to come. For example, the authors of the Allee, Emerson, Park, Park, and Schmidt text are out of proper sequence (p. 12); a paper by Pearse, *et al.*, is attributed to Oliver, *et al.* (p. 606).

Every marine biologist and ecologist will find much of great value in this volume. Each specialist will find here a convenient review of those phases of marine ecology outside of his own specialty. The book is more than a compilation—it is a critical study, well organized, and expertly prepared. Points of disputation by others will only serve to advance the development of marine ecology. This is a cooperative venture of giant proportions in which many of the most eminent marine ecologists have contributed. The complexity of ecology is frequently pointed out in the discussions, which is a most desirable feature and a much needed emphasis for the beginning student. In addition to setting forth the ecological principles for the interpretation of paleoecology, this volume will also serve as a standard source book in the pure science of marine ecology.

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A MARINE BIOLOGY SYMPOSIUM

In the spring of 1956, scientists of many kinds were brought together at Scripps Institute of Oceanography to help create perspective as to the best directions to be followed in further research in marine biology. By implication the results of the symposium were to be used to help Scripps Institution plan the spending of a million dollar grant from the Rockefeller Foundation.

By design part of the group were aquatic scientists whose work concerned populations, processes, and patterns of life in the sea; the other part of the group included scientists whose work was related to the aquatic environment only because they were working with general aspects of living systems. A very strange combination of distinguished men thus met in discussion and in sessions at which invited papers were presented emphasizing approaches. The papers are the subject of a new book.¹

In its organization the book, like the conference plan, is bizarre. In part 1 are 13 papers on ecology; in part 2 are 10 papers on biochemistry and physiology plus two of the best ecological papers on environmental productivity strangely misclassified as physiology (Margalef and Rodhe); in part 3 are 4 papers classified as behavior; and in part 4 are 12 papers classified as genetics and evolution.

Although all papers emphasize approaches, the papers do not present approaches in the same way. Some are new research results given as examples; some are reviews; some are viewpoint statements; and some contain

¹Buzzati-Traverso, A. A. (editor). 1958. Perspectives in marine biology. A symposium held at Scripps Institution of Oceanography, University of California, March 24-April 2, 1956. University of California Press, Berkeley and Los Angeles. xvi + 621 pp., figs. & tables. \$10.00.

suggestions for further research. Selected and valuable comments are published after each paper. The volume is thus an assortment of mixed orientation and subject with notions, opinions, misgivings, half-baked hunches, and statements of hope. The book is a showcase at which many of the participants were presenting a sample of their best. Marine genetics is heavily emphasized for a subject in its infancy.

Permeating the book is a semantic argument which developed around the word "experiment." Early in the conference A. C. Redfield shocked some of his associates by setting up an antithesis between environmental science and experiment. The argument degenerated into a conflict between indoor and outdoor science. The editor added further confusion by misrepresenting environmental science as only descriptive.

For purposes of this review papers are grouped into 5 systems of approach. All are at least partially experimental in conceptual basis. It is abundantly clear that all of the five approaches are good, with underdeveloped potential.

Approach 1: Study of Marine Organisms for Their Inherent Interest

In this approach are included neither those who use the animals as means for understanding ecological systems nor those who use the animals as a tool for understanding general living systems. Among these studies may be Kon's study of the comparative distribution of vitamins in marine organisms; W. L. Belser's brief comment on the studies needed on marine micro-organisms; V. Loosanoff's interesting accounts of unsolved problems with shellfish; D. L. Ray's listing of some invertebrates which have interesting habits that fit them for experimental studies; W. Wieser's account of super-numerosity of re-

lated species of microfauna in the benthos; Y. Matsui's account of the pearl oyster *Pinctada*, its physiology, and pearl chemistry; R. Lewin's account of complex reproductive life cycles in the marine algae; Barigozzi's account of genetics in some aquatic species; and Montalenti's discussion of sex-ratio phenomena in the population genetics of some marine species.

Approach 2: Laboratory Studies on Marine Species Followed by Comparative Interpretation of Their Behavior and Functions in the Environment for the Purpose of Understanding Large Scale Phenomena in Nature

D. M. Rae advocated the development of a plankton husbandry, pointing to the negligible progress in culturing planktonic zooplankton and the shadowy suspicions of influence of organic compounds in water masses. C. M. Yonge described experiments with corals and other animals which have symbiotic zooxanthellae and attempted to interpret the workings of reefs from data of the laboratory.

Luigi Provasoli's discussion of vitamin requirements of marine algae in the laboratory and vitamin distribution in nature involved joint use of the field observational and autecological methods. P. Miyadi used indoor facilities to interpret large scale outdoor phenomena involving marine fish behavior. A. Hasler reported experiments with fishes involving migratory responses and evidences from observations of migratory movements in nature. T. Waterman compared the patterns of polarized light in the sea and the responses of some marine animals in experimental studies with polarized light in the laboratory.

Approach 3: Intensive Observational and Analytic Study of Bottom Animals in the Environment

On the side of approaches of environmentally oriented science was a brief statement (in absentia) by the Russian Zenkevitch pointing out the advantages of wise international cooperation in ocean-wide sampling studies. Pierre Drach of the University of Paris recommended qualitative and quantitative description of the sea bottom faunas. Riedl urged better bottom sampling equipment. Thorson and Douglas Wilson reviewed papers on bottom animals and larval stages discussing the presence of parallel species in different areas with similar roles and the prevalence of physiological mechanisms in animals which permit species to complete life cycles by larval settlement on a bottom environment of suitable type. W. Wieser presents data on the distribution of deposit feeders in which both comparative functional anatomy and comparison of bottom types are involved. Barnes presents results of photography of bottom animals and plankton with underwater television.

Approach 4: Study of Environmental Processes in the Field with Modern Techniques and Experimental Concepts

Rodhe, Vollenweider and Nauwerck presented the results of extensive radioactive carbon studies of photo-

synthesis in lakes with implications drawn about methods, chlorophyll, and seasonal and vertical patterns of natural photosynthesis. Margalef's paper on the species patterns in natural systems and its comparison to entropy functions is a major contribution in experimental thinking with observational data in giant systems. The successful correlation of causative factors and biological events is reported by A. C. Hardy in the waters about England. This is an example of the use of natural experimental situations of the great sea systems. Selected samplings of natural test situations are provided by Tonolli for plankton distribution in space and by Bogorov for seasonal distributions.

Approach 5: General Study of Living Processes

A number of the participants advocated study of the general problems of living systems without special reference to the sea or to marine animals as the quickest approach. C. S. Pittendrigh reported on biological clocks in *Drosophila* and *Euglena*. F. Brown summarized his evidences of endogenous cycles related to external cycles. A Szent-Györgi presented his latest theory of muscle function. E. S. Guzman Barron reported some miscellaneous kinds of cellular experiments done at a marine station. T. Bullock discussed the fluid state of knowledge and the lack of unifying principles in the physiology of adaptation and homeostasis. Novick summarized the microbial evolution which could be observed in biochemical adaptation in a chemostat. Thorpe discussed mechanisms and descriptive terms concerning behavior. D. I. Arnon presented an account rich with examples concerning the role of micronutrients in plants.

Few are likely to find objection to these reports of well-known scientific approaches, but there are likely to be many who ask what these reports have to do with the sea. Marine phenomena involve basic living processes but are also larger, different, and born of a composition of physical cycles, ecosystems and populations of organisms.

It cannot be said that perspective in marine science was created by the 8 page summarizing section. Buzzati-Traverso confuses his classification separating "biological studies" from "oceanographic studies" by a scramble of ecological topics in both. Many study organisms only so as to understand the sea; others study the sea only for its organisms.

Much better perspective can be found in the published comment of one participant, Bostwick Ketchum, "The interaction of scientists studying adjacent levels of organization offers the most promise for the development of marine biology."

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METHODS IN CHEMICAL OCEANOGRAPHY¹

Non-chemists in particular will welcome this volume; which constitutes the first, generally available reference

¹Barnes, H. 1959. Apparatus and methods of oceanography. Part one: chemical. George Allen and Unwin Ltd., London; Interscience Publishers Inc., New York. 341 pp., 44 figs., 55 tables. 40 s, \$5.75.

and text in oceanographic chemical methods. Oceanographic departments and institutions have issued their own sets of directions for private use from time to time, and students of oceanography amass miscellaneous notes on the subject. Likewise, those engaged in water sanitation have available the APHA "Standard Methods." For