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Reviews

John E. Bardach, John H. Ryther and William O. McLarney: Aquaculture, the farming and husbandry of freshwater and marine organisms. Wiley – Interscience, London and New York, 1972. 868 pp., £ 15.95.

Food production in aquatic environments, loosely described as aquaculture, is an enormously diverse subject. It embraces not only the management of many different types of animals and plants but also a wide range of technical practices, from the pragmatic approach of peasant farming to the sophistication of intensive factory farming methods. Aquaculture is not new; its origins probably go back to a time when agriculture was still at a primitive stage but, unlike agriculture, it has not been taken up and carried forward by the scientific and technical advances of the post-industrial revolution era, except in some special cases such as trout farming. This has led to a strange dichotomy; on the one hand, the predominant aquacultural systems, in production terms, are poorly documented and barely touched by scientific innovation, while research and development studies have largely concentrated on new systems or species for future use.

In their book, Bardach and his colleagues have made a comprehensive review of all forms of aquaculture, including fish, shellfish, crustacea and plants. This review covers present practice and research throughout the world and is based on material derived from the literature or collected in personal interviews. Much of this material was collected by Bardach and Ryther for a report to the American Institute of Biological Sciences and, in the present volume, has been up-dated and collated by McLarney. There are 43 chapters, an appendix on pond siting and construction, and three indices covering personnel and their location, names of animals and plants, and general subject matter. Most of the chapters start with a historical introduction and end with a prospectus on economic or scientific grounds. The subject matter is well laid out, with clear subheadings, and the text is adequately supplied with photographic illustrations, diagrams and tables.

The first chapter discusses general principles and economics of aquaculture. The rest, ranging in length from 3 to 69 pages, deal with specific types of culture on a roughly taxonomic basis. Individual species, or groups of related species, are thus treated separately. There is some cross-referencing, but not enough to offset the impression that the book is a set of essays on the cultivation of various organisms, linked only by the simple fact that they are grown in water. Well over half the book is devoted to fish farming, with major chapters covering important species such as carp, mullets, tilapias and salmonids. The rest is equally divided between molluscs and crustacea, with two small chapters on plant culture; there is, in addition, a chapter on frog culture.

How well the authors have achieved their aim "... to give an overview of present, and to some extent past, practices of food aquaculture the world over, ..." must depend, to some extent, on the reader and his needs. The fly sheet lists as possible beneficiaries, a catholic collection of academic, scientific and commercial personnel. They certainly will not all be satisfied. For teaching institutions, the book will be very useful because of its comprehensive nature and the reasonable balance achieved, in depth of treatment, between popular forms of fish cultivation and the more speculative systems for the future. The fact that much of the material derived from interviews is not readily available in the literature also commends this volume to anyone wishing to instruct on the broad variety of aquatic farming. The scientist will be the least satisfied of potential readers chiefly because the literature cited is not very adequate, neither is it linked precisely with the text. Tables and diagrams are attributed accurately to source but this is not so for statements in the text. The narrative is smoothly constructed and easy to read but this seems to have been achieved at the expense of critical appraisal. Many statements appear to be wildly improbable: e.g., that carp can spawn 6 times a year under tropical conditions and that pigment deficiency in hatchery-reared plaice is a consequence of loss of patches of larval skin. Many other statements are highly contentious but receive no criticism or qualification from the authors, who appear to inject their personal experience and judgement only in the prospectus which concludes each chapter. The scientist will certainly find fault with chapters dealing with his own specific interests; that on flatfish rearing,

for example, will be quite foreign to anyone experienced in this rather specialized field, and the description of sturgeon farming in the USSR hardly does justice to this highly successful enterprise.

For the commercial reader the book has much to offer, since it is written partly in the style of an instruction manual. Again, the specialist will want more information than is contained in the present volume, but it does set out clearly the practices, and some of the statistics, of marine and freshwater cultivation in a variety of countries and under diverse social and economic constraints.

In conclusion, this is a welcome addition to the growing library on aquaculture. It is the most comprehensive book of its kind and is written in a clear style which will appeal to laymen as well as to professionals within the field. The main fault is the absence of critical appraisal which perhaps is inevitable in such a comprehensive work based more on personal interviews than on published scientific work.

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R. W. Edwards and D. J. Garrod (Eds.): *Conservation and Productivity of Natural Waters*. Symp. Zool. Soc. Lond., (29), 1972, 318 pp.

This book contains the proceedings of a symposium held in London in October 1970. Unlike many symposia the papers are nearly all relevant to the title of the book. They are divided equally between fresh water and marine topics. The former include papers on rivers and lakes and cover subjects from nutrient inputs to fish production. Of particular interest are two papers on potential applications of fresh water research. Steel suggests that in reservoirs affected by excess algal production, the control of vertical mixing using inlet jets could produce a decreased primary production rate and lead to a balance between algae and herbivores. This might provide an alternative or an addition to chemical treatment. Alabaster et al. discuss the usefulness of short-term toxicity tests in relation to pollution of rivers. They suggest that combined effects are largely calculable from tests with individual poisons. Further, they demonstrate an empirical relation between these results and the presence or absence of fish in rivers in the Midlands of England. In this way the relatively simple short-term tests may have predictive value.

The marine papers cover a similar spectrum from plankton to fish. Colebrook describes the linear decrease with time in a number of zooplankton species in the North Sea. However, these changes over the last 22 years have not been linked convincingly with climatic change nor would it be possible to differentiate between these natural changes and any cumultative effects of pollution. For another North Sea problem, the preservation of nursery grounds in the Dutch Waddensea, Zijlstra describes the surveys which have demonstrated the general importance of this area for plaice and sole. Thus a partial closure by dykes could have a significant effect on recruitment to these fish stocks, but this cannot be quantified at present.

This conjunction of fresh water and marine papers illustrates not merely the difference in scale of the problems but also the consequent difficulties in application of results in the marine field, particularly in relation to some of the more recent types of human activity. It is valuable to have such comparisons available in one volume.

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Gabriel Godin: The Analysis of Tides. University of Toronto Press / Liverpool University Press, 1972. 260 pp., £ 14.00.

The title of this beautifully prepared book may perhaps convey the wrong impression. The prospective purchaser should not expect to find a point by point account of how to perform various types of tidal analysis, instead the reader is presented with a very useful collection of information on the underlying theories of the various tidal analysis methods.

Two chapters serve to prepare one for the main bulk of the book. The first, an introduction, starts with such fundamentals as Newton's laws of motion, celestial motion and various types of clocks and calendars and develops the concept of tidal potential and its treatment by various workers. The second chapter entitled *Basic Mathematical Notions* deals with such concepts as Fourier series and Fourier transforms and then develops into a discussion of the spectrum of a function. The problems of aliasing and of resolving adjacent spectral lines from a finite length, discretely sampled time series are studied before an extended treatment of filtering is undertaken.

The remainder of this chapter concerns itself with power spectra and cross spectra and the effects on these of noise, trends and steps in the original data series. These introductory chapters do their job of acquainting the "novice" with the basic terminology