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### Book Reviews

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## BOOK REVIEWS

T. E. L. Langford: *Ecological Effects of Thermal Discharges*, publ. Elsevier Applied Science, Barking UK, New York USA; £69.00; 468 pp., illustrated, bibliography and index. ISBN 1-85166-451-3

Terry Langford has followed his earlier successful volume “Electricity Generation and the Ecology of Natural Waters”<sup>1</sup> with a further detailed analysis of the growing literature on this subject.

The contents include early chapters to summarise knowledge about thermal discharges and the disposal of heat, as well as the physical and chemical characteristics of thermal discharges. There is a thoughtful comparison of field, experimental and predicted biological effects, followed by a systematic review of work reporting effects on major faunal and floral groups: bacteria, fungi and heterotrophs, algae and macrophytes, rotifers and micro-crustaceans, macroinvertebrates, and vertebrates.

The rapid development of thermal electricity generation in the United Kingdom in 1950s and 60s, with a similar development in North America, led to concern among aquatic ecologists that the effect of heated discharges to fresh waters would destroy higher aquatic communities irrevocably, and would irreversibly change marine waters. This concern was contemporary with those identified<sup>2</sup> as “fashionable”, oxygen balance and eutrophication, in those two decades. In more recent decades, these have been replaced progressively by heavy metals, acidification and organic micropollutants and nitrates.

The earlier Langford text was the fruit of the author’s many years’ experience of investigation and assessment of conditions at UK generating stations, and an enlightened review of work elsewhere, especially in North America. The present volume extends the theme further into the question of ecological response, a difficult task in view of the innate variability of affected sites, the evident but undocumented effects of other variables, and the uneven nature of many reports. Indeed, to have gathered in data from the “grey literature” of company reports is, in itself, a mammoth task.

With increasing use of environmental impact assessment as an early and specified step in project planning, both developers and regulatory authorities will need to have at least some insight and knowledge of the extensive literature available, even though some characteristics of each site will be unique. Both scientists and others involved in the complex process of assessment and decision making will find this work an invaluable exhaustive source of reference. For the aquatic biologist, the book will be an exhausting “read” but a reasonable index and a full bibliography allows a selective dip into the text as interests are identified.

Although ill-thought out designs of cooling systems have sometimes wrought ecological damage in receiving waters intemperate climates, this is now infrequent, and indeed unnecessary with current technology and reasonable expendi-

ture. In tropical climates, and especially in countries harrassed by limitations of a shrinking water resource and little capital investment, I suspect that thermal pollution in the strict sense<sup>3</sup> may still occur, especially where naturally high levels of temperature are enhanced by an incremental component, more difficult to reduce in a humid and tropical climate. Yet in these developing countries, maintaining the productivity of aquatic life is even more important, since nearby communities are often dependent on it for food, employment and economic resource.

In conclusion, Langford makes a plea for more effort on the part of ecologists to study natural ecosystems for sufficient time, and in sufficient detail and habitat diversity, to make valid predictions that can be effectively incorporated into planning proposals. This requires attention to the focus of the EIA study and cautious extrapolation to conditions sometimes different from those of common experience or investigation. At present, it seems that the bulk of work has been undertaken in temperate waters. The expectation of further developments in tropical and arctic conditions suggests that there is still work to be done in relation to site conditions in these extremes, as well as to take account of new technologies for power generation and other industries.

Finally, there is a warning also, that without sound and relevant data, predictions of disaster and other exaggerations promoted by the media and self-interest can thrive, leading to hasty and ill-considered control legislation, often ineffective and costly as a consequence. These are views I have always promoted and, with such concordance, I recommend this book to a variety of users—be they ecologists, industrial or control authority scientists, and administrators who need to know the full story.

Gwyneth Howells  
15-11-90

### References

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2. Meybeck, M. *et al.*, (1990) *Global Freshwater Quality*, publ. WHO/UNEP, Blackwells.
3. GESAMP (1984) *Thermal Discharges in the Marine Environment*, Reports and Studies, No. 24 publ. FAO.

**Environmental fate of pesticides**, edited by D. H. Hutson and T. R. Roberts. *Progress in Pesticide Biochemistry & Toxicology* vol. 7, Wiley & Sons, 286 pp., ISBN 0 472917117, 1990

When I picked up this volume to read it prior to review, the title led me to expect a reasonably balanced and comprehensive approach covering the "state-of-the-art" in this important subject. However, reference to previous volumes in the series would have given warning of a certain unevenness, and this was confirmed in the present book. If you are expecting a textbook on the fate of pesticides you will be disappointed, but there are nevertheless many nuggets of useful information and insight that perhaps justify the fairly high price (£65).

The main criticism of this work is the minimal degree of editorial control which appears to have been exercised. For example, 11 out of the 13 contributions originate from industry. This is not, of course, necessarily a bad thing but more than once one detects an over-optimistic gloss placed on our ability to foretell pesticide fate. Furthermore, in two cases (Chapters 1 and 5) the authors launch into tirades against the capricious whims of regulatory authorities, which although partially justified, in my view have no place in a scientific compendium of this type.

Another editorial problem concerns the varying depths of analysis to which each subject is treated. This is exemplified by Chapters 6 and 7, both of which deal with fate in aquatic ecosystems, but at rather different levels. I leave the reader to decide which of these Chapters is the more useful—at the least there is much repetition here. It is clear that some of the authors believe they have an audience of experts already “in-the-know” (see Chapter 9 for the prime example), while others sensibly do not assume excessive prior knowledge and make an attempt to explain complex issues starting from first principles. Thus, although there is probably something for everyone in this volume, its value as a comprehensive and accessible work of reference is limited.

These problems aside, the book deals usefully with the major fields of pesticide fate (groundwater, soil, air, surface water, aquatic sediment and aquatic organisms). There is frequent use made of particular examples which help to bring the sometimes indigestible theory to life and several chapters also helpfully address the practical problems associated with predicting and measuring the fate of chemicals in the environment.

Chapter 1 gives a competent perspective on the whole subject, although it is clearly a viewpoint from the pesticide industry. We are therefore treated to ritualised complaints about the lack of a common regulatory approach, and to claims that regulators merely resort to “tick-lists” rather than using a logical tiered sequence of tests. Given the variety of ecosystems worldwide, I find it scarcely surprising that regulators have developed a variety of ways for assessing pesticide fate, and in my experience the ‘tick-list’ syndrome is confined to only a few authorities. Nevertheless, most points made are helpful (e.g. don’t place your trust in soil leaching columns, lysimeters or mobility models!), and it is easy to resist blandishments about the supposed minimal importance of persistence in soil and aquifers and of transport to surface waters.

Chapters 2–4 deal with various aspects of pesticide behaviour in groundwater. Chapter 2 presents a fairly lightweight overview that inexplicably digresses into health guidance levels, but it again warns of the limitations of leaching models—we are good at predicting *whether* pesticides will leach but not at forecasting the actual concentrations to be expected in groundwater. Chapter 3 is a workmanlike description of the available methods for the conduct of field research studies, while Chapter 4 devotes fully 44 pages to the basics of hydrogeology and its influence on fate. Having waded through this admirable theoretical treatment, one is then told that some compounds (e.g. PCBs) which are not expected to migrate to groundwater in fact confound these predictions! Clearly we still have much to learn. I suspect Chapter 4 may be insufficiently detailed for hydrogeologists and rather indigestible for the rest of us, although it covers an area to which many ecotoxicologists should pay greater attention.

Chapter 5 is an excellent treatment of fate in soils enlivened with four helpful

imaginary case histories. The chapter is marred somewhat by more sniping at the regulators about inflexible protocols etc. This of course conveniently side-steps the fact that such (admittedly limiting) procedures were originally introduced to assist manufacturers who complained about vague regulatory requirements.

The areas covered in Chapters 6 and 7 are essentially the same—fate in water and sediments. This repetition seems to be a waste of space, although Chapter 7 goes on to tackle the methodology and modelling techniques in more detail, and is generally clearer and more fluent. Chapter 6 also introduces the subject of bioconcentration and biotransformation in aquatic organisms, but this is much more fully treated in Chapter 8. Once again, tighter editorial control would have been welcome, although perhaps it is no bad thing to have the message rammed home by covering the ground twice. Chapter 8 very competently describes the main metabolic routes of pesticides in fish and convincingly explains why fish often differ from mammals in their susceptibility to these chemicals. This chapter concludes with a comprehensive review of bioaccumulation—both its prediction and measurement.

The final Chapter is a highly technical discussion of photolytic degradation which assumes considerable chemical knowledge. This is rather heavy going for a humble ecotoxicologist which is not eased by frequent confusions between adsorption and adsorption. There is great emphasis placed on the importance of surface-catalysed reactions which is followed by a slightly incongruous description of methods for measuring photomineralisation on surfaces. Aquatic photolysis unfortunately only gets the briefest of mentions so we cannot assess its relative contribution to pesticide degradation.

Taken in its entirety, this book is something of a Curate's Egg which on balance is nevertheless worth having on your shelf. It contains a wealth of information—although little that can be described as "Progress"—and its lists of references would alone make it a useful buy. We will, however, have to wait a while longer for the definitive volume on this important subject.

Peter Matthiessen