

Book Reviews

Inland Waters of Southern Africa. An ecological perspective.

B.R. Allanson, R.C. Hart, J.H. O'Keeffe and R.D. Robarts

Kluwer Academic Publishers, Dordrecht, 1990

415 pages

Price: £100

The limnological community has been waiting for this specific book for some time, for two reasons. Southern Africa has not had a thorough stocktaking of its limnology before and the senior author Professor Brian Allanson, the doyen of southern African limnologists, would seem to be most people's choice to handle the task. The fact that he has drawn in three eminent colleagues to help him write it makes the document so much more exciting in anticipation. So perhaps a long review is in order.

The scope of the book is broad. Geographically, it covers a region that stretches from approximately the Zambezi River southwards, which means it includes the Okavango Swamps and the two great artificial lakes of Cahora Bassa and Kariba. South Africa is covered best, which reflects the relative amount of research done in the region. The limnological coverage is not exhaustive and this is not a textbook. It is merely a perspective influenced strongly by the fields of expertise of the four authors.

The book's relevance is put into some perspective in the foreword written by the eminent Australian limnologist W.D. Williams. He raises a pet theme of his, namely that as classical north-temperate limnology was carried out on one fifth of the world's land mass there is an imbalance in limnological research and literature which needs correcting. As southern Africa tends to be arid like large parts of the world its limnology needs to be publicized. Allanson supports this argument in the Introduction.

Most of the limnology covered was done during the last thirty years before which reporting was mainly anecdotal. It follows some early attempts at synthesis, notably that organized by the Zoological Society of Southern Africa on 'Causes and problems of animal distribution, with special reference to South Africa' (Balinsky 1962) and 'Biogeography and Ecology of Southern Africa' (Werger 1978). Although limnology of a high standard was carried out, only in 1984 was a proper synthesis attempted via a Symposium (Davies & Walmsley 1985) and Workshop (Hart & Allanson 1984) on perspectives in southern hemisphere limnology. The specific objectives were: (i) to review and synthesize features of southern hemisphere low latitude inland waters; (ii) to examine the degree to which limnological principles developed in the northern hemisphere may be applied to southern hemisphere inland waters; and (iii) to interpret current knowledge in the light of environmental concerns, management strategies and future research and management needs.

Allanson considers the current book to be an extension of the Symposium, in that it develops a number of themes which are particularly characteristic of the limnology of semi-arid regions. But he does not consider it a definitive text on the limnology of the subcontinent. It is rather a fulfillment of the need to assemble those components of the database which have contributed to a deeper understanding of limnological features of the aquatic landscape of the subcontinent. So the question arises whether the authors have succeeded; alternatively, what have they covered and

what have they left out.

The book is divided into three parts. Part I (Chapters 2 to 4) 'The subcontinent' covers geomorphology, climate and regional limnology and was written by Allanson. Part II (Chapters 5 to 9) 'The rivers and their catchments, floodplains and wetlands' was written by O'Keeffe. It covers types of rivers, unique rivers, river research since 1900, riverine wetlands and the influence of man. In Part III 'Natural and man-made lakes' Allanson wrote Chapter 10 which covers suspensoids, hydrodynamics and chemical conditions. Robarts wrote Chapters 11 and 12 on primary producers and their production, and on bacteria and their activity. Chapters 13 and 14 on planktonic and benthic invertebrates and on fish and fisheries were written by Hart.

The coverage is skewed by the interests of the authors and the water bodies on which they have worked. The most notable gap, acknowledged by the authors, is the limited coverage of fish-related topics. This exacerbates the old problem of fish biologists as to where their allegiances lie — with limnologists, with aquaculturalists, with general zoologists or just plain on their own. One wonders whether the addition of a fish biologist to the list of authors wouldn't have solved the problem, even at the cost of some of the other coverage. In general, limnologists in the region will be unhappy that their pet interests have been neglected and that readers will get a biased impression of work done in southern Africa. Unfortunately, bias will always creep into any review of scientific literature and these authors have, in all fairness, hidden behind their subtitle.

Allanson starts off (Chapter 2) with a very useful description of the geomorphology of southern Africa. These 11 pages are liberally illustrated with photographs and figures relevant to water flow and water bodies. The next six pages on climate tell about radiation, the seasonal influences of the intertropical convergence and about seasonal and long term rainfall patterns. I found this chapter almost too brief to be useful, particularly regarding the inundation patterns in different parts of the subcontinent. Something on evaporation patterns would have been useful.

The subcontinent was divided into five limnological regions (Chapter 4) which is a useful partitioning of the subcontinent on a broad basis, and the major limnological features in each region are discussed. The regions are: the subtropical coastal peneplain (Mozambique, Transvaal/Zimbabwean Lowveld, Northern Natal/Kwazulu and Swaziland); the summer rainfall Highveld region stretching to the south-east coast; the mountain massif of Lesotho; the temperate acid waters of the south-west Cape; and the arid west (Karoo, Botswana, Namibia). It should, however, be remembered that within these regions there are very clear geographical subregions and local heterogeneity which the author has not gone into. I have a problem with the second (summer rainfall) region which includes such disparate parts as Okavango, Kariba and Cahora Bassa, the Orange Free State Highveld and the coastal lowlands of southern Natal. Allanson uses alkalinity and turbidity of water, related to the underlying geology (erosion of the Karoo system), as his basis for defining this region. He relates the diversity of the region to latitude and altitude.

From Part II onward there is more detail. Chapter 5 begins with a new description of the geographical differences in waters of the subcontinent, based on rainfall, runoff and temperature. This is followed by a section on river classification which splits up southern Africa into Harrison's (1959) hydrobiological regions. The apparent disagreement between O'Keeffe's and Allanson's geographical subdivisions stresses the point that biogeographical subdivision depends largely on your interest. O'Keeffe acknowledges this problem and submits Noble & Hemens's (1978) classification of South African rivers as a further alternative.

The 'unique rivers' looked at in Chapter 6 are the Zambezi, Okavango and Orange, with an apology for leaving out the

Limpopo. These are obvious selections, but we might say what about some others, particularly the Vaal. Although part of the Orange River system, it is certainly a special case, unique in its economic influence and degree of modification. The coverage of these rivers is once again related to the author's own interest (invertebrates), and consequently very little is said about macrophytes or algae, photosynthesis and light regimes. The next chapter (7) which reviews river research in southern Africa since 1900 has similar problems in that it seems to cover invertebrate studies only. I concede that these might be the backbone of river research from studies of zonation (starting with Harrison's work) to indicators of pollution (Chutter and others) to the river continuum concept. But I miss the fish studies and more recent botanical work.

Even though this is purported to be only a perspective, I think we should remember that the authors were looking at the whole subcontinent. In Chapter 8 (Riverine wetlands), coverage on the Okavango extends to social anthropology while its adjoining wetland, the Linjanti/Chobe swamp isn't covered, nor is mention made of other well-known riverine wetlands including Nylsvley and Memelvlei. O'Keeffe has chosen to spend the limited space available to him on two systems (the other being the Pongolo). It seems a pity but maybe the comment is unfair considering the limited space available because even the coverage of the Okavango and Pongolo is brief.

Then we get into cultural influences in Chapter 9 and here O'Keeffe covers catchment changes, river regulation, water abstraction and the conservation of rivers. Once again very interesting studies are included, from the Kruger Park's rivers and the Zambezi to some Natal and eastern Cape rivers. The Vaal is mentioned but it is, and will be even more so with the fruition of the Lesotho Highland water scheme, by far the greatest example of human influence on a river in the subcontinent. It should have been central, even though some very useful research has been done on the other rivers.

Chapter 10 is a considerably more technical coverage of physical and chemical aspects of man-made lakes with the most detailed coverage devoted to hydrodynamics. This field in itself is so technical that Allanson found it necessary to spend a good part of the chapter explaining a number of equations and models developed by Imberger and Patterson in Australia before he could use them to explain conditions in local water bodies. Nevertheless I believe this part of the book will be referred to much more often than some other parts because of its depth of coverage; unfortunately the book would have been considerably longer if other parts of it had been dealt with in the same depth — something of a dilemma for the authors. The chapter succeeds in analysing the categories of physical and chemical processes in man-made lakes of the region and perhaps justifies the allocation of an eighth of the book to it.

The next chapter, on primary producers and their production, is equally long. The coverage is split between lakes, inorganically turbid reservoirs, biogenically turbid reservoirs and aquatic macrophytes in reservoirs. It does justice to most wet fields and national 'problems'. Coastal lakes have been given the least attention, probably because the science of these water bodies was concentrated at higher trophic levels. Lake le Roux and Wuras Dam, the inorganically turbid reservoirs, were contrasted with the less turbid Lake Midmar, while Hartbeespoort Dam holds centre stage as a eutrophic (biogenically turbid) reservoir. Macrophytes feature in their own sub-chapter as well as under lakes and reservoirs. Here Allanson merely reviews the literature on distribution and production of both 'problem' (*Salvinia*, *Eichhornia*, *Azolla* etc.) and other species.

The bacteria chapter (12) is divided into two sub-chapters on lakes and reservoirs, respectively. The former deals with work

done mainly on coastal lakes in the 1970s by the Institute for Freshwater Studies in Grahamstown, beginning with the studies of Hart and Bowen, who looked at bacteria as food for zooplankton and fishes respectively, and continuing with Robarts himself (the author of this chapter) and others on bacterial activity in southern Cape lakes. The decomposition of macrophytes was an important part of this work. The sub-chapter on reservoirs is much larger and covers more recent work, especially on macrophyte decomposition in Wuras Dam and phytoplankton decomposition processes in the much larger hypereutrophic Hartbeespoort Dam. Only the heterotrophic bacteria are considered and not the cyanobacteria (*Microcystis*) which for convenience are dealt with elsewhere in the book as phytoplankton.

Hart's chapter (13) on the planktonic and benthic invertebrates is a full 66 pages. He describes it as '... a preliminary attempt to assemble information derived from a variety of studies generally inconsistent with the purpose to which their findings are presently being applied. It is accordingly superficial and incomplete, particularly as a result of taxonomical uncertainties ...'. So it is an attempt at synthesis based on flawed and incomplete information, which must always be the case in science and therefore is nothing new. Nevertheless it implies that much more basic work is necessary and it suggests that the author is attempting a broad assessment of the field rather than just expanding on a limited number of useful studies. It shows up gaps that need to be filled but it in fact also shows that more has been done than one might have expected of the limited manpower in the field. One of the biggest gaps is in the field of taxonomy and zoogeography — we very often don't know what species we are studying. A certain amount has been done on the spatial distribution of zooplankton. The greatest depth of study has been on the seasonal distribution, production, community composition and ecological role of the zooplankton as a whole. Most of the work covered was carried out in impoundments, especially Lake le Roux and Hartbeespoort Dam. Benthic studies in impoundments have been scarce in comparison.

The fish chapter (14) is really superficial and should either have been left out or expanded. It looks like a late addition.

The final short synthesis and implications chapter is unsatisfactory. It doesn't really draw the threads of the book together as it might. It doesn't really state clearly what is special about limnology in the region and it doesn't really identify gaps in the research that need to be filled. However it does, in the last two paragraphs, raise some valid points on the exclusion of limnologists from being fully integrated members of resource teams, either with regard to planning or to execution and maintenance. No one in particular is blamed and the book ends on a positive note of hope and faith in man's ability to recognize his need for the environment.

I find this book to some extent parochial in its coverage, all the authors being members or alumni of the Institute of Freshwater Studies in Grahamstown. It is a bit thin on water bodies outside South Africa, which largely reflects uneven research coverage. It also, more seriously, gives poor coverage of the Vaal River, fish, algae and macrophytes.

How forgivable is this biased coverage? It depends on who you expect your readers to be. Is this a monograph, textbook or review? In fact it touches on all three, largely depending on the author of the specific chapter. Mostly it is a review, as seemed to be the intention. Sometimes it becomes a monograph when the author tells us all about his own work (all the authors are guilty here and there) and sometimes it becomes a textbook (e.g. Allanson's explanation of hydrodynamics).

I'm still not clear about the target reader. Shouldn't we rather have had monographs about certain water bodies? On the other hand, there has been no synthesis of this depth on this region

before, so maybe it was necessary, and whoever the authors might have been, even if twenty had been chosen, they would each have had their own perspectives. It does put a lot under one cover for use as a broad reference either by students, teachers or scientists. However, researchers will still have to go to the original documents and even go ahead of this book because it is inevitably dated.

Finally its value must also be weighed against its availability which is related to its price of about R500 (£100) before tax and postage which will dictate who uses it. It is too expensive for students and most researchers to buy privately (indeed the price exceeds 25% of the monthly take-home salary of a great number of southern African limnologists), so it will be bought by libraries. The publishers have given a special discount to southern African limnologists but it remains expensive. One has sympathy for the authors, who are not responsible for the price, which is presumably due to its small print run.

It is a very well prepared book with a comprehensive reference list and more than adequate separate indexes for authors, organisms and general topics. There are few typographical errors — unfortunately the first one is on the sixth line of text. I was disappointed in the photographs (all monochrome) which often reproduced poorly and could have been more appropriately chosen.

All in all this is a well-written, well-presented book, generally thorough in its coverage, with some shortcomings but it will become a necessary reference for southern African, southern hemisphere and indeed many global limnologists.

MAITLAND SEAMAN

Department of Zoology and Entomology, University of the Orange Free State, Bloemfontein

Kalahari hyaenas: the comparative behavioural ecology of two species

M.G.L. Mills

Academic Division of Unwin Hyman Ltd, London, 1990

304 pages

Price: £40,00

This is a well-written and well-illustrated account of detailed information collected through an immense investment by Gus Mills and his family while studying the behavioural ecology of two species of hyaena in the semi-arid southern Kalahari. Although centering on hyaenas a lot of information on other mammals which affect hyaenas and are in turn being affected by hyaenas is provided. Most of these examples may well serve as 'textbook' examples of African vertebrate predator/prey interactions. Much of the data presented on hyaenas in this book have been published previously. However, in the book Gus succeeded in synthesising this previous work in scientific journals by incorporating previously unpublished records and observations.

The aims of the long-term study were to assess the roles of the brown and spotted hyaena in the southern Kalahari ecosystem and to identify those factors responsible for limiting their numbers. This book contributes greatly to our understanding of carnivore behavioural ecology, as well as our appreciation of a large mammal community in a pristine environment. I feel that the strength of this book lies in the extended period covered by the study (1972 to 1984) and the intensive long-term observations on

individuals.

The book was written largely for the benefit of the scientific community, but the style of presentation also offers an opportunity to the interested lay-person to gain some insight into the scientific approach to animal studies, and to learn something about two animal species that have fascinated mankind since ancient times.

The introduction to the study, study area, the methods used and the animals studied is followed by chapters on feeding ecology, comparative foraging and feeding behaviour, social structures and spatial organization, communication patterns and social interactions, comparative denning behaviour and development of cubs, the role of the individual in the hyaena society, relationships between the species, and management considerations for brown and spotted hyaenas.

The introduction of each chapter is followed by the presentation of results and a discussion on the specific aspect covered. These are supported by analysed data presented in the form of tables and figures, with statistical variables and tests at the end of each chapter greatly facilitating the readability of the text. Furthermore, aspects reflected on in the text are supported by several black and white photographs, and the summaries given at the end of each chapter are very useful abstracts of the contents of each chapter.

The chapter on feeding ecology (I have a personal bias against the use of the word 'ecology' here) provides quantitative information on food availability, the diets of brown hyaenas and spotted hyaenas, consumption rates, the diets of other large carnivores (i.e. lion, leopard, cheetah), and evaluates the impact of predation on prey populations. The relationships between hyaenas and other carnivores is also discussed.

The chapter on comparative foraging behaviour describes the activity patterns, foraging group sizes, the use of senses during foraging and the hunting behaviour of the two species, certain of which were published some 12 years ago by the author. It also deals with their feeding behaviour and evolutionary considerations relating to this aspect in an attempt to explain variations in the group sizes of spotted hyaenas.

In the chapter on social structure and spatial organization, forces responsible for changes in clan structure are considered, and followed by descriptions of the land tenure system of hyaenas. Factors affecting the sizes of social groups and territories are discussed and the author concludes that the resource dispersion hypothesis can account for much of the variability in group and territory sizes of hyaenas.

In the chapter on visual and tactile communications the author shows that the basic postures signalling certain behavioural tendencies are similar in the two species but that fundamental differences arise from differences in the time spent in groups by members of the two species.

Considering the difficulties involved in describing the functional significance of vocalization, I am not surprised that the section on vocalization is somewhat incomplete but nevertheless interesting to read. Most of the information presented here on scentmarking has been published before, but its inclusion contributes significantly to the general aims of the book.

Chapter 6 deals with comparative aspects of denning behaviour and the development of cubs. It is concluded that the need to leave guards at the den has been obviated by the nature of dens and that communal suckling in brown hyaenas can be explained through kin selection. From the author's observations it also appears that benefits may accrue from communal denning if there is sufficient food in the territory to support more than one breeding female.

In Chapter 7 the author describes how individual hyaenas behave to maximize their genetic contribution to the population. Here he also considers the evolution of the social organization of the two species, their mating systems and reproductive strategies. The chapter largely comprises descriptions of events recorded that

relate to the role of the individual in the hyaena society and an evolutionary interpretation thereof.

In the final chapter which deals with management, it is concluded that as long as large conservation areas are maintained in their present state the future survival of the brown hyaena can be viewed with optimism. It is also concluded that the survival of spotted hyaenas depends on the long-term future of such conservation areas.

Finally, I enjoyed reading this book and would like to recommend it, in spite of several printing errors, to anyone interested in behavioural ecology, and specifically, the functioning of mammal communities and hyaenas. It is of course a must for all academic institutions.

RUDI VAN AARDE

Mammal Research Institute, University of Pretoria, Pretoria 0002

Bird Migration

Edited by E. Gwinner

Springer-Verlag, Berlin & Heidelberg, 1990

435 pages

Price: DM196

The phenomenon of bird migration continues to fascinate anyone with an interest in natural history, and provides a fertile area for theoretical speculation, observation and experiment. Much of the research, as Gwinner notes in his introduction, has focussed on the problem of orientation, which has been the subject of numerous reviews and symposia. This book contains 26 invited papers, presented at a 1988 symposium which concentrated on the physiological and ecophysiological aspects of bird migration. There were 36 contributors, 14 from North America, and the rest from six European countries. The intended audience is professional ornithologists and physiologists.

The book is divided into five sections termed chapters, although the topics covered in each chapter are often quite diverse, as the following synopsis indicates. (1) Patterns of migration: land birds crossing large expanses of ocean; migration in the Arctic; timing and routes of passerine migration in East Africa; migration in the Alps; weather effects on the timing of migration; moult migrations. (2) Ecological and behavioural aspects of migration:

site fidelity in migrants; ecophysiology of movements in winter quarters; control of partial migration; habitat selection in winter quarters; ecology of migrants and residents. (3) Physiological adaptations to migration: visual problems for nocturnal migrants; nutrition and food selection; fat storage and metabolism; endocrine mechanisms; circannual rhythms; genetics of migration. (4) Avian flight: mechanics of flight; physiology of flight; energetics and water economy. (5) Strategies and tactics of migration: optimal migration; trans-Saharan migration; migration in arid and mountainous central Asia; migration of north temperate waders; leap-frog migration in waders; problems of energetic studies of migration.

Clearly some articles cover special topics which are of limited interest to many readers: the Arctic and the Alps are far afield for southern African biologists, and only two papers deal specifically with work in Africa, although a few studies in southern Africa are cited. However, moult migrations occur in local ducks, and are clearly relevant to the conservation of particular species. Site fidelity and the biology of migrants on their 'wintering' grounds are practical topics for local research. From my own reading, I found that the articles on endocrine mechanisms and circannual rhythms covered familiar ground, but the visual problems of diurnal birds migrating at night were novel, and I also learnt a good deal about fat reserves and energetics. The section on flight is an attempt to relate laboratory findings to the migrants on the wing, and together with the articles on nutrition, provides a link to the theoretical paper on optimal bird migration. However, the results of the field studies presented in the final section illustrate again the 'credibility gap' between models and the real world. The brief final paper highlights such problems, and suggests possible methods of attack.

Overall this volume presents a valuable sampling of current migration research on topics other than orientation, and provides a glimpse of present knowledge and future directions for research in selected fields. References cited in full follow each article. As in any multi-author work, the style of writing varies, but none of the contributions are so long or densely referenced that reading becomes wearisome. Local purchasers are likely to be restricted to a few institutional libraries, but hopefully some readers will be stimulated to initiate research in this area; there is plenty of scope for work on migrant birds in southern Africa apart from merely ringing them.

ADRIAN CRAIG

Department of Zoology & Entomology, Rhodes University, Grahamstown, 6140

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