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Book Review

ECHOLOCATION IN BATS AND DOLPHINS
Editors: Jeanette A. Thomas, Cynthia F. Moss, Marianne Vater. University of Chicago Press, 2004. ISBN 0-226-79599-3, 604 pp., PBK: 45 USD.

Since the first biosonar symposium in 1966, scientists studying animal echolocation have met approximately every ten years to discuss and report their findings. Each symposium has resulted in a book containing a rich collection of seminal papers. The fourth and most recent meeting was held in Carvoeiro, Portugal, in 1998. Six years later, the proceedings of this meeting have been published. Does the new book live up to the high standards of the previous volumes? The answer to this question depends on the reader's expectations.

The introduction to the book, on comparing bat and dolphin echolocation, is written by Whitlow Au. The only two similar reviews known to me are also written by Au, and I find this latest one the most comprehensive. It may serve as an appropriate introduction to the field of echolocation and to the problems of measuring and comparing echolocation abilities and signals of animals living in air and water.

The book contains 73 scientific papers, written by 145 authors. Some papers have the character of short reviews, but most of them report novel scientific results. The papers are grouped into six parts covering all major aspects of echolocation: (1) sound production, (2) hearing, (3) cognition, (4) behavioural ecology, (5) signal analysis, and, finally, (6) echolocation in other species than bats and dolphins. Each part starts with an introductory chapter, having the format of a mini-review. Among these I especially like the ones by Schuller and Moss about bat vocal control (Chapter 1), by Vater and Kössel on whale and bat ears (Chapter 12), and by Denzinger et al. reviewing the behavioural ecology of bat sonar (Chapter 42).

The first part of the book contains, besides the introduction, ten papers on echolocation signals. There is a very useful review on odontocete sound production by Cranford and Amundin (Chapter 4). Dubrovskiy and Giro's paper, a dolphin click production model (Chapter 10), has sparked continued work by several research groups long before being printed. In contrast, some chapters in this part are outdated because the same data are more thoroughly treated in other recent papers.

The second part of the book contains 20 chapters covering the anatomy and physiology of hearing and forms one of two major portions of the book. There are several chapters on the physiology of bat audition, showing that the understanding of neurophysiology is by far more sophisticated for bats than for dolphins. It would have been useful to have included a discussion on how much of the conclusions drawn from studying bat neurophysiology could be extrapolated to dolphins. Studies recording the auditory brainstem response (described by Supin and Popov in Chapter 22) have recently given us a better understanding of some of the neural processes in the dolphin brain without using intrusive techniques. Do such new techniques make future intrusive work unnecessary for dolphins, also for bats? Another interesting odontocete paper in this part is by Schlundt et al., who presented important data on the effect of project position when measuring hearing thresholds in dolphins (Chapter 15). This methodological problem may be of paramount importance in many bioacoustic applications.

The third part of this book starts with a paper by Masters and Harley (Chapter 33) reviewing the performance and cognition of echolocation. This paper would have benefited from the addition of a few illustrations to highlight the text. In addition, some of their conclusions seem a bit outdated. For example, the debate about the suggested matched-filter hearing of bats has moved several papers ahead. Also, the recent important work by Moss and coworkers on auditory scene analysis and on the acoustic behaviour of free-flying bats are not mentioned. Similarly, the discussion on work from Popper's lab on ultrasound detection in clupeid fish would have benefited from the inclusion of some important and more recent findings. The following eight papers in this part cover some interesting bat target-detection studies, as well as several reviews on object recognition by dolphins. Besides Surlykke's important paper on multiple echo detection threshold in bats (Chapter 37; this work has recently been shown to be of importance for dolphins by Altes and coworkers), I find Roitblat's discussion on object recognition in dolphins (Chapter 39) and Pack et al.'s review on dolphin acoustic shape perception (Chapter 41) especially instructive and useful as general introductions to these fields.

The fourth part is on behavioural ecology, and it contains 19 papers. This forms the second major portion of the book. There are several interesting reviews: Rydell on the evolution of bat defense in moths (Chapter 43), Schnitzler et al. on the evolution of echolocation by bats (Chapter 44),

Brock-Fenton on foraging niches in bats (Chapter 47), and Herzing and dos Santos on echolocation in dolphins (Chapter 53). Among interesting chapters covering experimental work is Schotten et al. who describe a small hydrophone array (Chapter 54). This array has already inspired similar work to describe echolocation signals in the field from at least four other species of odontocetes. Another important paper is Herzing's description of the social and nonsocial use of echolocation in Bahamas dolphins (Chapter 56); however, the methodology in this chapter suffers from the very common problem among field-working marine bioacousticians of using recording systems only detecting the sonic part of the echolocation clicks. Speakman et al.'s work on relating echolocation to metabolic rate (Chapter 49) should serve as an important inspiration in this field of research, which is gaining more and more attention. Jones and Barlow provided a good discussion of the cryptic species of echolocating bats (Chapter 46).

The book's fifth part contains seven papers on signal analysis and echolocation theory. Parsons and Obrist contributed with an updated summary on biosonar recording techniques (Chapter 62). Altes' discussion on synthetic apertures (Chapter 65) and Kuc's description of a biomimetic sonar (Chapter 66) may have significant impact on biosonar studies focusing on free-flying bat and free-swimming dolphin echolocation behaviour. Aubauer et al. described a phantom-echo generator as a novel tool for dolphin echolocation studies (Chapter 68).

The sixth and final part of the book deals with echolocation in other mammals than bats and dolphins. Schusterman et al.'s introduction is a comprehensive summary of pinniped sensory abilities (Chapter 69). He focused on evidence for why these animals do not echolocate. There is a contradiction between this paper and the following two chapters, giving evidence that both leopard (Awbrey et al., Chapter 70) and Weddell (Evans et al., Chapter 71) seals do indeed produce signals that are suitable for echolocation. The remaining two chapters deal with evidence of echolocation in insectivores and rodents (Thomas and Jalili, Chapter 72), and in baleen whales (Clark and Ellison, Chapter 73). This part of the book would have benefited from a more general introduction that attempted to define what echolocation really is, and thereafter giving specific examples from seals, insectivores, rodents, and whales, with an evaluation of the existing evidence. A goal for the next biosonar meeting should be to come up with a more comprehensive treatment on this issue.

There are some items of an editorial nature that cause confusion to the reader. Of minor importance is that a list of author affiliations is missing, which makes it impossible to assess the academic distribution of research groups in bioacoustics. More important is the structure of the reference list that is split up between the various parts of the book. This makes the reading and information search more confusing.

An even more crucial editorial issue is to define the general purpose of publishing this book. From the front-cover and back-cover text, this book seems to aim at filling an indeed dire need for an introductory text to biosonar, comparing the performance of bats and dolphins; however, from reading the preface of the book, the editors' purpose seems to be to summarize the Carvoeiro conference. The contradiction between these incompatible aims is clear when reading the book. Some chapters deliver broad, high-quality reviews on specific topics of biosonar. Others report on premature experiments, far from being ready for a peer-review process. Some authors make a lot out of referring to other chapters of the book, while some papers are stand-alone contributions.

Is the book living up to the standards of previous biosonar conference proceedings as milestones that summarise the essence of present work? It seems as if this volume is less groundbreaking than the preceding volumes, mainly because this volume has suffered from a seriously delayed publication by which many of the chapters have been published elsewhere or have been superseded by other recent studies. Still, the book serves as a valuable volume for bioacoustic scientists in the early 21st century. It contains many papers which have already made an important impact by inspiring future studies of bioacoustics. It is nice to see all these interesting pieces of new work in a single book, together with a good share of high-quality reviews. It is important to point out, however, that the general reader should not be misled to believe from the front and back covers that this book can serve as a general introduction to biosonar.

A synthesis of bat and dolphin echolocation work is very important. Many bat studies should become important inspirations for dolphin scientists. A major reason for the present division into bat and dolphin biosonar camps is the problem of accessing comprehensible reviews in the various fields of study. This book supplies an inspiring set of such reviews, which will be a great help to bridge the gap between bat and dolphin biosonar scientists. The recent breakthroughs in both bat and dolphin biosonar research, not covered in this book, call for a new biosonar meeting soon, despite the fresh ink from the Carvoeiro proceedings.

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