

Book Review

THE SONAR OF DOLPHINS. Whitlow W. L. Au, 1993, Springer-Verlag New York

This book is an authoritative, precise and comprehensive treatise in 277 pages of what is known about sonar (or echolocation) in dolphins, written by the leading scientist in the field.

The field is an interdisciplinary one, with inputs from marine mammalogy, physiological acoustics, psychology, underwater acoustics, and engineering. W. W. L. Au has his background in the latter field, a fact reflected in the organization and presentation of the material. Of the twelve chapters in the book, three deal with the auditory system (heading key words: Receiving System), another three with the sound producing system (heading key words: Transmission system), while others cover target detection, discrimination and classification, signal processing and models. One chapter is devoted to a comparison of bat sonar with dolphin sonar, and in the final chapter the topics that are still uncharted areas in the cartography of dolphin sonar are outlined.

Such areas of the unknown are quite conspicuous. Many will be surprised to learn that after so much excellent research and diverse approaches it is not yet generally agreed how and where dolphins generate their powerful clicks, the most intense sounds known to be produced by any creature. Nor is the path of sound from the water to the inner ear known for sure, although some hypotheses have more adherents than others. Throughout the book Au, quite carefully keeps the options open, and yet his own preferences are not hidden for the careful reader.

While the engineering approach might keep some students of the topic with e.g. a naturalist's background from reading the book, they are hereby warmly recommended to reconsider their attitude. If you really want to understand the workings of the bio-sonar, the concepts and parlance of engineers cannot be avoided, nor can this book. After all, the goal of experimental biology is to understand and describe the mechanisms of nature in physical terms in such detail that they can be formalized mathematically. The topic and its treatment in this book is a fine example of this process. The author has for many years been in the core of a research group (working mainly at a lagoon facility at Kaneohe Bay, Hawaii) comprised

of psychologists, psychophysicists, biologists, and physicists, and this book clearly benefits from his extensive experience in getting his message across to people of different backgrounds.

For those in the field of bio-sonar, whether they study bats or dolphins, this book is likely to be the reference point for quite some time. Of course, bat sonar is here dealt with largely in a comparative way, but the concepts and analyses developed by dolphin sonar research are general, and so powerful that they cannot but make an impact also in the competing field of bat sonar research, especially since they now are presented in a comprehensive form.

Other readers of the book may be students of man-made sonars. In a number of respects (outlined in the book), dolphin sonar is superior to man-made sonar, irrespective of the fact that the basic concepts all have their origin in man-made sonar. For classes in signal analysis and neural networks, the book would seem to be a rich source of inspiration, based as it is on well defined performance of animals that are bound to fascinate any reflective mind.

The book is well illustrated and organized, with references at the end of each chapter. However, the index has only about 200 subject entries and no author index. With the original references parcelled out to the individual chapters, it occasionally takes some time to check out the current state of a specific topic.

Experiments are described in such detail that a need to confer with the original papers rarely occurs. This is valuable, since the primary literature is scattered over many journals (quite a few being Russian), and proceedings from symposia. In some cases, information not given in the original papers, is added. One case is a worked-out example of how the statistical uncertainty in detection threshold experiments is calculated by the Hawaiian group. Such information is interesting to the specialists since it in part explains the high precision obtained in dolphin work as compared with similar work in bats, where a different calculation tradition has evolved.

In summary, the Sonar of Dolphins is indispensable for those, who really want to understand what is known about the main sensory input of these animals. For the uninitiated, I do not imagine the book to be easy reading, but as it is of high quality,

all serious efforts to extract from its wealth of information are bound to be rewarding.

Bertel Möhl
Department of Zoophysiology
University of Aarhus
DK-8000, Denmark