

Springer Handbook of Auditory Research

Volume 66

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ASA Press

Hans Slabbekoorn • Robert J. Dooling
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Editors

Effects of Anthropogenic Noise on Animals



Editors

Hans Slabbekoorn
Faculty of Science
Institute of Biology Leiden (IBL)
Leiden University
Leiden, The Netherlands

Arthur N. Popper
Department of Biology
University of Maryland
Silver Spring, MD, USA

Robert J. Dooling
Department of Psychology
University of Maryland
College Park, MD, USA

Richard R. Fay
Loyola University Chicago
Chicago, IL, USA

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This volume is dedicated to the memory of Professor Douglas B. Webster (1934–2017), a remarkable teacher, mentor, scholar, colleague, and friend. All of the editors know Doug’s fascinating work on hearing in desert rodents, but Dick Fay and Art Popper had the

pleasure of working closely with Doug on two very important volumes in which his scholarly expertise was critical to the success of the books. The first was The Evolutionary Biology of Hearing (Webster, D. B., Fay, R. R., and Popper, A. N., 1992, Springer-Verlag, New York) and the second was volume 1 in the SHAR series in which Doug was the first senior editor (The Mammalian Auditory Pathways: Neuroanatomy, Webster, D. B., Popper, A. N., and Fay, R. R., 1992, Springer-Verlag, New York). Art is particularly grateful to Doug because it was in Doug's lab at New York University that Art (then an undergraduate) was first introduced to comparative biology and research on the auditory system.

Acoustical Society of America

The purpose of the Acoustical Society of America (www.acousticalsociety.org) is to generate, disseminate, and promote the knowledge of acoustics. The Acoustical Society of America (ASA) is recognized as the world's premier international scientific society in acoustics, and counts among its more than 7000 members, professionals in the fields of bioacoustics, engineering, architecture, speech, music, oceanography, signal processing, sound and vibration, and noise control.

Since its first meeting in 1929, the ASA has enjoyed a healthy growth in membership and in stature. The present membership of approximately 7000 includes leaders in acoustics in the United States of America and around the world. The ASA has attracted members from various fields related to sound including engineering, physics, oceanography, life sciences, noise and noise control, architectural acoustics; psychological and physiological acoustics; applied acoustics; music and musical instruments; speech communication; ultrasonics, radiation, and scattering; mechanical vibrations and shock; underwater sound; aeroacoustics; macrosonics; acoustical signal processing; bioacoustics; and many more topics.

To assure adequate attention to these separate fields and to new ones that may develop, the Society establishes technical committees and technical groups charged with keeping abreast of developments and needs of the membership in their specialized fields. This diversity and the opportunity it provides for interchange of knowledge and points of view has become one of the strengths of the Society.

The ASA's publishing program has historically included *The Journal of the Acoustical Society of America*, *JASA-Express Letters*, *Proceedings of Meetings on Acoustics*, the magazine *Acoustics Today*, and various books authored by its members across the many topical areas of acoustics. In addition, ASA members are involved in the development of acoustical standards concerned with terminology, measurement procedures, and criteria for determining the effects of noise and vibration.

Series Preface



Springer Handbook of Auditory Research

The following preface is the one that we published in volume 1 of the Springer Handbook of Auditory Research back in 1992. As anyone reading the original preface, or the many users of the series, will note, we have far exceeded our original expectation of eight volumes. Indeed, with books published to date and those in the pipeline, we are now set for over 75 volumes in SHAR, and we are still open to new and exciting ideas for additional books. We are very proud that there seems to be consensus, at least among our friends and colleagues, that SHAR has become an important and influential part of the auditory literature. While we have worked hard to develop and maintain the quality and value of SHAR, the real value of the books is very much because of the numerous authors who have given their time to write outstanding chapters and to our many co-editors who have provided the intellectual leadership to the individual volumes. We have worked with a remarkable and wonderful group of people, many of whom have become great personal friends of both of us. We also continue to work with a spectacular group of editors at Springer. Indeed, several of our past editors have moved on in the publishing world to become senior executives. To our delight, this includes the current president of Springer US, Dr. William Curtis. But the truth is that the series would and could not be possible without the support of our families, and we want to take this opportunity to dedicate all of the SHAR books, past and future, to them. Our wives, Catherine Fay and Helen Popper, and our children, Michelle Popper Levit, Melissa Popper Levinsohn, Christian Fay, and Amanda Fay Sierra, have been immensely patient as we developed and worked on this series. We thank them and state, without doubt, that this series could not have happened without them. We also dedicate the future of SHAR to our next generation of (potential) auditory researchers—our grandchildren—Ethan and Sophie Levinsohn, Emma Levit, and Nathaniel, Evan, and Stella Fay.

Preface 1992

The Springer Handbook of Auditory Research presents a series of comprehensive and synthetic reviews of the fundamental topics in modern auditory research. The volumes are aimed at all individuals with interests in hearing research including advanced graduate students, postdoctoral researchers, and clinical investigators. The volumes are intended to introduce new investigators to important aspects of hearing science and to help established investigators to better understand the fundamental theories and data in fields of hearing that they may not normally follow closely.

Each volume presents a particular topic comprehensively, and each serves as a synthetic overview and guide to the literature. As such, the chapters present neither exhaustive data reviews nor original research that has not yet appeared in peer-reviewed journals. The volumes focus on topics that have developed a solid data and conceptual foundation rather than on those for which a literature is only beginning to develop. New research areas will be covered on a timely basis in the series as they begin to mature.

Each volume in the series consists of a few substantial chapters on a particular topic. In some cases, the topics will be ones of traditional interest for which there is a substantial body of data and theory, such as auditory neuroanatomy (Vol. 1) and neurophysiology (Vol. 2). Other volumes in the series deal with topics that have begun to mature more recently, such as development, plasticity, and computational models of neural processing. In many cases, the series editors are joined by a co-editor having special expertise in the topic of the volume.

Richard R. Fay, Chicago, IL, USA
Arthur N. Popper, College Park, MD, USA

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Volume Preface

Over the past several years, many investigators interested in the effects of man-made sounds on animals have come to realize that there is much to gain from studying the broader literature on hearing and on the effects of sound, as well as from data on the effects of sound on humans. It has also become clear that knowledge of the effects of sound on one group of animals (e.g., birds or frogs) can guide studies on other groups (e.g., marine mammals or fishes) and that a review of all such studies together would be very useful to get a better understanding of the general principles and underlying cochlear and cognitive mechanisms that explain damage, disturbance, and deterrence across taxa.

The purpose of this volume, then, is to provide a comprehensive review of the effects of man-made sounds on animals, with the goal of fulfilling two major needs. First, it was thought to be important to bring together data on sound and bioacoustics that have implications across all taxa (including humans) so that such information is generally available to the community of scholars interested in the effects of sound. This is done in Chaps. 2–5. Second, in Chaps. 6–10, the volume brings together what is known about the effects of sound on diverse vertebrate taxa so that investigators with interests in specific groups can learn from the data and experimental approaches from other species. Put another way, having an overview of the similarities and discrepancies among various animal groups and insight into the “how and why” will benefit the overall conceptual understanding, applications in society, and all future research.

Chapter 1 by Hans Slabbekoorn, Robert J. Dooling, and Arthur N. Popper provides an overview of the topic of the book and an introduction to the chapters.

The next two chapters address hearing complications and perceptual strategies under challenging conditions in terms of noisy and complex acoustic environments. Chapter 2 by Robert J. Dooling and Marjorie R. Leek addresses the phenomenon of masking of biologically relevant sounds while in Chap. 3, Micheal L. Dent and Mark A. Bee go beyond masking as they address the perceptual mechanisms for extracting relevant signals from a background of potentially distracting sounds. This is followed by Chap. 4 in which James C. Saunders and Robert J. Dooling address issues related to sound levels that are very high and result in potential hearing

damage. At the end of this part of the book, Chap. 5 by Ole Næsbye Larsen and Craig Radford covers the physical properties of air and water in terms of sound transmission.

In Chap. 6, Anthony D. Hawkins and Arthur N. Popper start the taxonomic reviews by addressing what is known about fishes. In Chap. 7, Andrea Megela Simmons and Peter M. Narins address the literature on the effects of man-made sounds on amphibians, which include not only frogs and toads but also salamanders, newts, and the caecilians (limbless amphibians). Then, in Chap. 8, Wouter Halfwerk, Bernard Lohr, and Hans Slabbekoorn focus on birds, including the relatively homogeneous and well-studied songbirds, about half of all 10,000 species of birds.

The final two chapters turn to mammals. In Chap. 9, Hans Slabbekoorn, JoAnn McGee, and Edward J. Walsh address the wide-ranging hearing abilities as well as the wide-ranging types of investigations on the sound impact for the diverse group of terrestrial mammals. Then, in Chap. 10, Christine Erbe, Rebecca Dunlop, and Sarah Dolman address marine mammals, including cetaceans (whales, dolphins, and porpoises) and sirenians (sea cows) that are fully aquatic, and also several marine carnivores (seals and walruses) that spend time both on land and in water.

Hans Slabbekoorn, Leiden, The Netherlands
Robert J. Dooling, College Park, MD
Arthur N. Popper, College Park, MD
Richard R. Fay, Chicago, IL

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Contributors

Mark A. Bee Department of Ecology, Evolution, and Behavior, University of Minnesota, St. Paul, MN, USA

Micheal L. Dent Department of Psychology, University at Buffalo, State University of New York (SUNY), Buffalo, NY, USA

Sarah Dolman Whale and Dolphin Conservation, Chippenham, Wiltshire, UK

Robert J. Dooling Department of Psychology, University of Maryland, College Park, MD, USA

Rebecca Dunlop Cetacean Ecology and Acoustics Laboratory, School of Veterinary Science, University of Queensland, Gatton, QLD, Australia

Christine Erbe Centre for Marine Science and Technology, Curtin University, Perth, WA, Australia

Wouter Halfwerk Department of Ecological Sciences, Faculty of Earth and Life Sciences, VU University Amsterdam, Amsterdam, The Netherlands

Anthony D. Hawkins Loughine Ltd, Aberdeen, UK

Ole Næsbye Larsen Department of Biology, University of Southern Denmark, Odense M, Denmark

Marjorie R. Leek VA Loma Linda Healthcare System, Loma Linda, CA, USA

Bernard Lohr University of Maryland, Baltimore County (UMBC), Baltimore, MD, USA

JoAnn McGee Developmental Auditory Physiology Laboratory, Boys Town National Research Hospital, Omaha, NE, USA

Peter M. Narins Department of Integrative Biology and Physiology, University of California, Los Angeles, Los Angeles, CA, USA

Department of Ecology and Evolutionary Biology, University of California, Los Angeles, Los Angeles, CA, USA

Arthur N. Popper Department of Biology, University of Maryland, College Park, MD, USA

Craig Radford Leigh Marine Laboratory, Institute of Marine Science, University of Auckland, Warkworth, New Zealand

James C. Saunders Department of Otorhinolaryngology, Head and Neck Surgery, The Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

Andrea Megela Simmons Department of Cognitive, Linguistic and Psychological Sciences, Brown University, Providence, RI, USA

Department of Neuroscience, Brown University, Providence, RI, USA

Hans Slabbekoorn Faculty of Science, Institute of Biology Leiden (IBL), Leiden University, Leiden, The Netherlands

Edward J. Walsh Developmental Auditory Physiology Laboratory, Boys Town National Research Hospital, Omaha, NE, USA