Volume Preface

Fishes comprise the largest group of vertebrates by far. Indeed, there are more extant species of fishes than there are of all other vertebrate species combined. And, with this diversity in species, fishes show remarkable diversity and adaptations in the ways in which they deal with the aquatic environment. The diversity of structure and function in sensory systems is exceptional, and suggests that, as fishes have evolved, they have found "new" ways to gather information about their highly diverse environments. This diversity is particularly evident in the octavolateralis system of fishes, the inner ear and the lateral line: the senses that detect water motion and sound.

This volume provides an overview of the octavolateralis system of fishes, but unlike earlier volumes on the topic, it takes an approach that explores fish bioacoustics both from a basic perspective of understanding how fishes detect and process signals and from an applied perspective that explores how bioacoustics is used to understand and affect fish behavior.

In Chapter 1, Fay, Popper, and Webb provide an historical perspective on the topic of fish bioacoustics and also give a brief introduction to "who" fishes are. This is followed in Chapter 2 by Popper and Schilt, in which the authors explore hearing capabilities and mechanisms of fishes, and put these findings into the context of several applied approaches to fish bioacoustics, including a discussion of attempts that have been made to use sound to "control" fish behavior. In Chapter 3, Fay and Edds-Walton continue the discussion of fish hearing, but examine the topic from the perspective of the physiology of the ear and the central nervous system. They emphasize the strong similarities between fishes and terrestrial vertebrates in the organization and function of the auditory brain. Finally, the issue of evolutionary adaptations of the auditory system for the detection and processing of the sound pressure waveform is examined by Braun and Grande in Chapter 4.

Despite being aware of the presence of the lateral line for centuries, it has only been relatively recently that investigators have started to really understand its critical function in the lives of fishes. The role of the lateral line is discussed from the viewpoint of morphology, physiology, and function in Chapter 5 by Webb, Montgomery, and Mogdans. They also discuss the interaction of input to the lateral line and inner ear which is expanded upon in Chapter 6 by Sand and Bleckmann, who discuss one of the most fascinating of all issues in fish bioacoustics: the orientation and localization to sound by fish. Sound source

localization is also treated in Chapter 7 by Rogers and Zeddies, who present a new and important model of the mechanism by which fish are likely to localize sound, and by Fay and Edds-Walton (Chapter 3), who discuss the central neural circuits that may underlie sound source localization.

Fishes use sound in a wide range of behavioral contexts, and this is explored by Bass and Ladich in Chapter 8. The theme of acoustic communication is continued in Chapter 9, where Mann, Hawkins, and Jech consider the use of sounds produced by fishes in applied approaches to fisheries biology.

As with other volumes in the Springer Handbook of Auditory Research series, the chapters in this volume are complemented by chapters in earlier volumes. Volume 9 in the series, *Comparative Hearing: Fish and Amphibians* (edited by Fay and Popper) has several chapters relevant to this volume including the structure of the ear (Popper and Fay), hearing capabilities (Fay and Megela Simmons), anatomy of the auditory CNS (McCormick), the lateral line (Coombs and Montgomery), and acoustic communication (Zelick, Mann, and Popper). The physical acoustics of underwater communication are discussed by Bass and Clark in Vol. 16, *Acoustic Communication* (edited by Megela Simmons, Popper, and Fay). Volume 22 in the series, *Evolution of the Vertebrate Auditory System* (edited by Manley, Popper, and Fay), has several chapters on the evolution of the octravolateralis system in fish including an examination of the evolution of the ear (Ladich and Popper), sensory hair cells (Coffin, Kelley, Manley, and Popper), and on environmental constraints on hearing and the concept of auditory scene analysis (Lewis and Fay). In the same volume, Clack and Allin discuss the transition from fish to land vertebrates in terms of changes in the ear. In Vol. 25, *Sound Source Localization* (edited by Popper and Fay), Fay discusses fish sound localization capabilities.

Two other volumes in the SHAR series are relevant and related to this one. *Electroreception*, Vol. 21 (edited by Bullock, Hopkins, Popper, and Fay) discusses another major sensory system of fishes that is related, in an evolutionary sense, to the octavolateralis system. Volume 28, *Hearing and Sound Communication in Amphibians* (edited by Narins, Feng, Fay, and Popper), considers many of the same topics that are considered in this volume, in a group of vertebrates that may be very instructive to help us further understand fish bioacoustics.

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