

## Book Review

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### Marine Benthic Dinoflagellates—unveiling their worldwide biodiversity. Hoppenrath, M., Murray, S. A., Chomérat, N. & Horiguchi, T. 2014. 276 pp. Senckenberg, Kleine Senckenberg-Reihe, Germany. [ISBN 978-3-510-61402-8]

Harmful algal blooms (HABs) have been a longstanding issue in the coastal waters of the Korean Peninsula. Many HAB species include planktonic dinoflagellates, which have been well studied to date. This monograph regarding benthic dinoflagellates unveils the ubiquitous distribution of marine benthic dinoflagellates along most of the world's coastlines. The worldwide biodiversity of benthic dinoflagellates had been underestimated prior to the publication of this book.

We began our benthic research several years ago by isolating benthic dinoflagellates from beaches and macroalgal surfaces. The species observed included harmful species such as *Gambierdiscus* spp., which is known to result in ciguatera fish poisoning in tropical seas. This treatise is a useful resource for Korean researchers that need to identify and classify HAB species.

Upon having read this book, I realized it would serve as a bible to help increase the accuracy and power of identification of Korean benthic dinoflagellates. The description of this book is both very precise and easy to understand, providing a comprehensive overview of benthic dinoflagellates and their survival strategies in benthic environments. Dinoflagellate diversity is very high, both in the sand and on macroalgal surfaces.

This work is composed of an introduction and materials and methods section, as well as information regarding taxonomy, phylogeny and systematics, biogeography, ecology, and toxins, all of which outline various aspects of benthic dinoflagellates. The introduction in Chapter I includes the history of dinoflagellate research, morphological characteristics, detailed morphological diagrams, and Kofoid's tabulation of plates, all essential for the identification of and increased understanding of benthic

dinoflagellates.

Chapter II, the materials and methods, provides a full information of techniques for sampling, isolating, culturing, and identifying dinoflagellates. Habitat information is very useful for the proper selection of sampling sites, locations where researchers can collect species with consideration for correctly isolating specimens from substrates, as well as how to culture them for further studies. The isolation of benthic species differs notably from that of planktonic species, in that the species can be separated from the sand by extraction with melting seawater ice through a fine filter.

Chapter III provides a taxonomical list as well as a description of all species in alphabetical order, including aspects crucial to identification, such as species type, plate tabulations, descriptions, synonyms, remarks, distribution, references, transmission electron and scanning electron micrographs, and drawings of the plates of each species. In addition to the name of each species, the etymology of each name provides the meaning of each species as originally published by the authors. The phylogeny and systematics of Chapter IV introduces evolutionary relationships, resulting from molecular sequencing, which could reveal novel fundamental evolutionary relationships. This chapter introduces a cutting-edge technique to resolve genetic differences down to the genus and species levels using molecular biomarkers. Although the 'dinotom', a dinoflagellate with a symbiotic diatom inside, is well described in ecology and taxonomy, there are a large number of unknown species in unexplored habitats such as the sediments of the deep sea, as well as inside host cells. This book not only guides us to deepen our knowledge of well-described species but also aims to elucidate our knowledge of those that are poorly understood.

Although the biogeographical information in Chapter V is limited owing to the fact that knowledge of the geographical distribution of some species is limited, it aptly explains the expansion of the ranges of some species as a result of global changes in climate. Based on similari-



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ties in distribution patterns, benthic dinoflagellates are divided into four groups—arctic, temperate, subtropical, and tropical species. Chapter VI characterizes dinoflagellates based on a variety of growth habits and habitat preferences, such as the interstitial spaces of marine sediments (i.e., sand-dwelling), epiphytic growth on the surfaces of macroalgae and seagrass (i.e., phycophilic), growth in tidal pool, and growth on floating detritus and corals, and thoroughly describes the characteristics of the species in the various habitats. The species are grouped in terms of attachment, vertical migration, bloom, spatial distribution, and temporal distribution, all with sufficient examples. Chapter VII explores the toxicity of species responsible for benthic harmful algal blooms (BHABs). One such species, *Gambierdiscus* spp., the dinoflagellate responsible for ciguatera fish poisoning (CFP), is thoroughly explained. This toxic species and others are listed

in a table along with toxin name, strain name, studies of toxicity, and references. This information is very useful for research involving HABs.

The size of this book—more akin to a field guide than a traditional, sizeable monograph—is light, portable, and no larger than a novel. Despite its small size, this compendium of information about benthic dinoflagellates provides a wealth of information and is very convenient for use under any working condition as well as in the field. In summary, the book is well edited and will be valuable to researchers as well as easily accessible to the interested layperson.

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