



**Abate M. E. & Noakes D. L. G. (Eds.)
2021. The Behavior, Ecology and Evolution of Cichlid Fishes. Springer International Publishing. 828 p. ISBN (eBook): 978-94-024-2080-7**

Cichlid fishes belong to the order Cichliformes and the family Cichlidae (NELSON et al. 2016). This family has a rich species diversity and many of its species are bred in the aquaculture industry and aquariums. This group constitutes a significant part of the global fish trade (RADKHAH & EAGDERI 2020 2021). Due to the aesthetic benefits of cichlids and their role in feeding millions of people around the world, various studies have been done on the biological and ecological aspects. One of the new books recently published by Springer International Publishing is entitled *The behavior, ecology and evolution of cichlid fishes*. This book, edited by Maria E. Abate and David L.G. Noakes, was prepared in collaboration with many researchers in the fields of aquatic ecology, evolution and behavior. Studying this book prompted us to provide a review on it.

The present book consists of 21 chapters. Chapters 1 and 2 look specifically at the biological and evolutionary studies of cichlids over the past 200 years, including the research in the 21st century. Chapter 3 deals with the origin, genetic diversity and ecological characteristics of African cichlids. It first discusses the species diversity of cichlids in Africa and how they adapt, and then focuses on their speciation mechanisms. Part of this chapter addresses the importance of preserving the genetic diversity of African cichlids, which is of great ecological importance. Chapter 4 examines the species diversity of cichlids and their ecological characteristics in the Congo River basin; it presents a list of species of cichlid fish in this basin, following with the examination of the environmental and geohydrological characteristics explaining the high diversity of cichlids. Part of this chapter deals with one of the most important species in the Congo River – *Lamprologus lethops* and its unique adaptations. Chapter 4 discusses the molecular phylogenetics of the Congolese cichlids and addresses two very important issues – colonization and hybridization. Chapter 5 focuses on Neotropical cichlids, which have more than 500 species and are frequent in Central and South America. At the beginning of this chapter, the author provides an overview of the past and present of Neotropical cichlids. Then, they point to the taxonomic diversity and geographical distribution of these fish in the Neotropical region. In another part of the chapter, the morphological and ecological diversity of Neotropical cichlids is examined, which is discussed by providing illustrations of different fish species; the evolutionary status of fish is studied separately in the two regions of North America and Central America. At the end of the chapter, divergence between river and lake populations is examined, which remains an important question among ichthyologists and ecologists. Chapter 6 examines the sympatric and allopatric compatibility of cichlids in Lake Nicaragua. In this chapter, after introducing the cichlids present in each of the lakes of Nicaragua, the allopatric and sympatric speciation of these fish and the morphological diversity among them are mentioned. The authors address issues such as parallel evolution and the process of functional changes in fish, including nutritional changes.

In Chapter 7, the authors examine the impact of human factors on cichlid fish communities in Lakes Victoria, Kyoga and Nabugabo. Information on the decline of native species such as members of *Oreochromis* and *Lates niloticus* in these lakes was presented. The authors cited overfishing, changing environmental and habitat conditions, especially eutrophication and depletion of oxygen, and declining water clarity as human stressors. Chapter 8 focuses on rapid evolutionary responses of cichlids and their genetic-morphological compatibility; the authors examine the

evolutionary responses of *Haplochromis pyrrhocephalus* and its genetic, morphological and nutritional characteristics. Chapter 9 focuses on identifying and conserving tilapia in the 21st century. In this chapter, tilapia species are introduced and their morphological features are reviewed. In an important part of this chapter, the authors focus on the threats and opportunities of tilapia conservation. Chapter 10 reviews the cichlids introduced to the Americas and, in addition to examining ecological features, points to their distribution and negative effects. Past studies have shown that the movement of fish between different habitats may be due to human interventions and for various purposes, including aquaculture. Due to this, a significant part of the cichlids introduced to the United States were transferred to this continent with the aim of developing aquaculture; however, they had frequently negative effects on the new ecosystem, causing a significant reduction in native fish.

Chapter 11 focuses on the visual ecology of evolution in cichlids. The authors first examine the eyes of cichlids physiologically and then the visual ecology of these fish and their relationship to environmental parameters such as water transparency. Studying the evolution in the visual ecology of these fish can be very interesting for species such as *Lamprologus lethops*, which live in habitats without light and whose eyes are blind. In Chapter 12, the authors study the lateral line system in cichlids. The interesting point in this chapter is that first detailed information about the physiology of the lateral line system in cichlids is provided along with interesting and useful photos and then the behavioral mechanisms of fish including swimming and feeding performance according to the physiology of the lateral line organ. In Chapter 12, the lateral line system is fully studied from anatomical to behavioral point of view. Chapter 13 is devoted to cichlids that produce sound; in the first part of the chapter, a checklist of different types of cichlids that are able to produce sound is provided. In the following, the mechanism of sound production and its reasons are reviewed, which is often associated with attracting the opposite sex and aggressive behavior. The authors examine the morphological features of the organs involved in sound production and describe the acoustic pattern of cichlids in different conditions.

In Chapter 14, the authors examine the auditory evolution of cichlids and their functional morphology as well as the role of ecoacoustical parameters. They consider the diversity in auditory auxiliary structures and auditory abilities. At the beginning of the chapter, the morphology of the inner ear and swimbladder as well as the auditory development of the cichlids is discussed. Although these studies are significant, many studies in this field lack ecological and phylogenetic perspectives. Chapter 15 deals with parental care in cichlids; it examines parenting care strategies that include gamete provisioning, nest preparation, and defense. The authors state that cichlids' parental care can be in the form of substrate guards, mouthbrooders and primitive mouthbrooding. Some species of cichlids have biparental care and some have a single parental care (male or female). Chapter 16 examines cichlids as a model for studying social behaviors and evolution. The authors state that it is possible to study the evolutionary and social behaviors of cichlids due to their effortless maintenance in aquariums and breeding environments. Chapter 16 first presents brief findings on the diversity of social systems in cichlids in early research and then discusses new studies on the subject. Chapter 17 focuses on the neurobiology of cichlids' social behavior. It provides brief information on the characteristics of the brain and the interactions between it and the social behaviors of cichlid fishes. Chapter 18 discusses the respiratory ecology of cichlids, addressing hypoxic conditions in aquatic environments and presenting cichlid strategies for survival in these conditions. These strategies include behavioral responses to hypoxia, increased oxygen uptake through physiological mechanisms, decreased aerobic demand. The authors point to the effects of hypoxia on fish growth, fecundity and reproduction. Chapter 19 focuses on the ecology of cichlid feeding in Lake Tanganyika. This lake, known is believed to be the oldest lake in Africa, has about 250 species of cichlids; their diversity, food network structures and coexistence mechanisms are described. Chapter 20 examines the patterns of trophic evolution. The authors study modularity at various levels, including phenotypic, genetic, functional and evolutionary. Chapter 21 examines the genomic and phylogenetic research performed on cichlids from the past to the present.

The reviewed book is an ideal and comprehensive reference in the field of cichlid biology. It can be used by various sections of the scientific community, from fisheries and aquaculture specialists to students and researchers in biology and ecology.

References

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