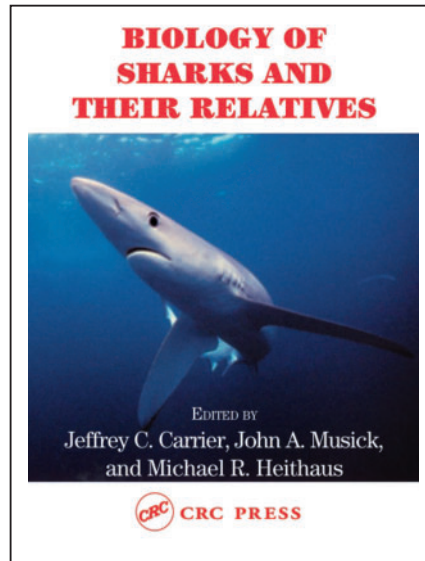


## A CHONDRICHTHYAN COMPENDIUM



### Biology of Sharks and Their Relatives

Edited by J. C. Carrier, J. A. Musick and M. R. Heithaus

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\$99.95

The table of contents of *Biology of Sharks and Their Relatives* is the first indication that this book's editors succeeded in their objective of compiling far more than just another book about the biology of the Class Chondrichthyes (sharks, rays, and chimeras). It is the scope of this book that distinguishes it. Its subjects include natural history, zoogeography and evolutionary relationships, and diverse aspects of mainly elasmobranch (sharks and rays) functional morphology and physiology. *Biology of Sharks and Their Relatives* is, moreover, a primer for the science and technology required for the development of strategies for conserving these organisms in the face of over-fishing and habitat destruction.

Divided into three sections, this volume contains 19 chapters, each authored by active participants in the disciplines about which they write. The book's first section, Phylogeny and Zoogeography, chronicles chondrichthyan relationships, biology and distribution. Although the chimeras occur mainly in deep waters, sharks and rays occur throughout the world's oceans in deep sea, oceanic and coastal habitats, and also in freshwater. Cladistic methodology permits the tracing of most chondrichthyan lineages back to the Mesozoic and, in the

case of chimeras, to the Paleozoic. Fossils further show that the batoids (electric rays, sawfishes, guitar fishes, skates, and stingrays) separated from their selachian (sharks) sister group in the Triassic. In summarizing these and other details, the chapter by Grogan and Lund reports how the diverse fossil chondrichthyan assemblage in the Permo–Carboniferous limestone deposits at Bear Gulch, Montana (USA) is providing new insights about the diversity of the earliest groups and their evolutionary relationships to extant forms.

The second section of *Biology of Sharks and Their Relatives* focuses on the integration of form, function and physiology. These contributions have been carefully prepared and provide generally thorough and well-referenced accounts of each subject. The locomotion chapter by Lauder and Wilga examines evolving concepts about the function of pectoral fins as a hydraulic lift counter-balance to the heterocercal tail. Its comparative overview also elucidates the independent origins of pectoral swimming in chimeras and batoids (where two types of pectoral movement, oscillatory and undulatory, appeared separately).

Chondrichthyans are distinguished from other fishes by their primarily cartilaginous skeleton and their exclusive use of internal fertilization. The roots of vertebrate hormonal regulation as well as the vertebrate immune system are readily evident among this group. Conversely, the high tissue and plasma urea concentrations that make sharks, rays and chimeras isosmotic or slightly hyperosmotic in seawater would denature the proteins and lyse the cells of most other vertebrates. Osmoregulation in this group involves kidneys, gills, the digestive tract and the rectal salt gland. Although the rectal gland is highly specialized for salt secretion and has been used as a comparative model for secretory fluid production and NaCl transport, it paradoxically does not seem absolutely essential for shark osmoregulation. The keen olfactory sense of elasmobranchs is augmented by their electrosensory capacity, which has both predatory and navigational utility. This sense also enables an embryonic skate to detect large predatory fish, to which it responds with antipredator freeze behavior. New works also document the pronounced visual acuity of some elasmobranchs; a great white shark can see a 15 cm target at a distance of 17 m. Many new facts and observations are thus incorporated into broad and different perspectives offered in the integrative section of *Biology of Sharks and Their Relatives*, which will stimulate

even the most knowledgeable students of the Chondrichthyes.

All chondrichthyans have internal fertilization, which improves survival odds by obviating the free-living larval development phase typical for bony fishes and resulting in the production of fewer, but larger offspring. For most elasmobranchs, the odds for offspring survival are further enhanced by the evolution of placental and aplacental uterine nurturing. However, that these remarkable specializations have a dark side is conveyed in the ominous sentences near the end of the Carrier, Pratt and Castro chapter on reproduction, '*The reproductive adaptations that have made elasmobranchs evolutionarily successful for eons, delayed maturity, long reproductive cycles, and small broods, now threaten their survival...with humans assuming the role of apex predator...elasmobranchs are being fished in quantities that may exceed their capacity to reproduce.*'

Indeed, this message seems to be the *raison d'être* for the volume's last section, Ecology and Life History, a guide to recent advances in the methodologies for the evaluation of elasmobranch populations. Featured here are the latest advances in age determination and validation, the assessment of population dynamics and demography, an especially clear and

practical guide to the nuances of population genetics, and an informative work describing the use of different tracking methodologies in the assessment of essential fish habitat.

A multi-authored volume of this size and scope invariably contains passages that are unclear, redundant, or contain errors. However, careful editing has minimized these. Nevertheless, the chapters are uneven with respect to the level of background a reader is presumed to have and some are rendered less useful by the use of terminology and concepts that are not explained and likely unfamiliar to the uninitiated. Also, rather than providing overviews of a subject, some chapters focus more on specific topics within a field. Depending on the reader's background, access to references, and patience, this can be either frustrating or exhilarating. This book's format, characterized by 14 cm-long text lines on 17 cm-wide pages and a small font size does not make for easy reading and some photographs are too small to reveal needed detail.

Although these limitations make *Biology of Sharks and Their Relatives* harder to use, the volume is a solid contribution and in many respects is far more than the sum of its parts. Nowhere is this better illustrated than by the dramatically different perspectives and data sets used in the three

highly distinct chapters on feeding (Prey Capture Behavior and Feeding Mechanics by Motta, Food Consumption and Feeding Mechanics by Wetherbee and Cortés, and Predator-Prey Interactions by Heithaus).

In summary, *Biology of Sharks and Their Relatives* is unlike any other book on the Class Chondrichthyes. It will be an important reference for all students of fish biology, marine biologists, and those concerned with fishery conservation and sustaining marine biodiversity. This book's scope extends from the diversity and morphology of early forms to the rapidly expanding knowledge of the biology of extant species (particularly the sharks), and to the future of sharks and their relatives. It sets out the kinds of science and technology that will be needed to ensure that the 400 million years of chondrichthyan history is not brought to an untimely end through over-exploitation and habitat destruction at the hands of a newly arrived apex predator that is both a clever and efficient hunter and also insatiable.

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