

# MONOGRAPHIAE BIOLOGICAE

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**H.J. Dumont**

University of Ghent, Institute of Animal Ecology,  
Belgium

henri.dumont@rug.ac.be

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# Marine Biodiversity of Costa Rica, Central America

Edited by

**Ingo S. Wehrtmann and Jorge Cortés**  
*CIMAR and Escuela de Biología, Universidad de Costa Rica, Costa Rica*

 Springer

*Editors*

Ingo S. Wehrtmann  
Unidad Investigación Pesquera y Acuicultura (UNIP) of the Centro de  
Investigación en Ciencias del Mar y Limnología (CIMAR),  
and Museo de Zoología, Escuela de Biología  
Universidad de Costa Rica  
11501-2060 San José, Costa Rica  
ingowehtmann@gmx.de

Jorge Cortés  
Centro de Investigación en Ciencias del Mar y Limnología (CIMAR),  
and Escuela de Biología  
Universidad de Costa Rica  
11501-2060 San José, Costa Rica  
jorge.cortes@ucr.ac.cr

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*Cover page:* Seagrass habitat at Parque Nacional Cahuita, Caribbean coast of Costa Rica (Photo: Ingo S. Wehrtmann)

*Back cover, photo 1:* A green algae, *Acetabularia calyculus*, from the Caribbean coast of Costa Rica (Photo: Ingo S. Wehrtmann)

*Back cover, photo 2:* *Carpilius corallinus*, a brachyuran crab occurring in the Parque Nacional Cahuita, Caribbean coast of Costa Rica (Photo: Ingo S. Wehrtmann)

*Back cover, photo 3:* A black turtle, *Chelonia agassizi*, observed in waters around the offshore island, Isla del Coco, Pacific Costa Rica (Photo: Jaime Nivia)

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Nancy Knowlton  
ant Chair for Marine Science  
ment of Invertebrate Zoology  
I Museum of Natural History  
Smithsonian Institution  
Washington, DC, USA

## Foreword

I live in the clouds, or more specifically, in the cool temperate Pacific Northwest, where rainclouds cloak the land during the winter months. Being optimistic by nature, I often slip out of my home on chilly nights to look upward. Usually there is a thick, opaque cloudbank. But fortune smiles sometimes on every one of us, and there are intervals when breaks in the clouds afford me a glimpse of the heavens. And, very rarely during our long, wet, gray winters, I get to see a dark sky resplendent with stars. Such a sight fills me with awe. I've enjoyed reading about astronomy for a half century, even briefly flirting with becoming an astronomer. I understand that some stars are brighter because they are far closer than others, or much larger, or burn their hydrogen much faster, sending their brilliance far into the cosmos. Even knowing this, I still wonder why some stars are so bright. And, being a biologist, I often wonder whether these distant places harbor the greatest miracle on our small, blue planet: life.

Anyone who travels knows that seeing new places changes the way we think. I first visited countries outside the United States and Canada in 1970, as a graduate student studying the ecology of blue crabs (genus *Callinectes*) in the Caribbean and tropical East Pacific. Among my first stops were the Smithsonian Institution's laboratories on the coasts of Panama. The more places I visited, the more I realized how little is known about their rich tropical biotas because most biologists reside and do their research in biologically impoverished industrialized countries. Only very scattered information was available about the marine species and ecosystems of Latin America when I did field work there. For example, in 1972 I was told that there had been almost no research on the estuarine biota of three sizable rivers in western Colombia where I trawled for portunid crabs. I wonder how much that has changed in the decades since then.

This knowledge is crucial, especially for scientists trying to understand how ecosystems function on large spatial scales, for people depending heavily on marine life for food, and for officials in places where human activities are affecting marine populations and ecosystems. It is also crucial for many visitors who love nature. Having read about and experienced ecosystems in other nations was essential to the idea of conserving biological diversity that I developed with Roger McManus when we worked at the President's Council on Environmental Quality in 1980. It was even more so when I assembled Global Marine Biological

Diversity: A Strategy for Building Conservation into Decision Making (1993) and my book with Larry Crowder, *Marine Conservation Biology: The Science of Maintaining the Sea's Biodiversity* (2005). Seeing ecosystems and meeting people from other places made me think about the world beyond my own habitat, my own circumstances. It parted my clouds, allowing me to comprehend that, in the world of nations, as in the universe of stars, some shine far more brightly than others. Costa Rica exemplifies this.

Nature has blessed Costa Rica with extraordinary biological diversity, from its forests to its seas. It is biologically rich because it's in the tropics where more species have evolved or where fewer have disappeared (or, quite possibly, both). It's biologically rich because it's topographically complex and offers an exceptionally broad range of physical conditions for life. It's biologically rich because it's a bridge between two large continents; species originating in both North and South America find suitable habitat there. It's biologically rich because it's bounded by the Earth's two biggest oceans, each of them home to rather different but very diverse assemblages of species.

Costa Rica is rightly famous worldwide for its terrestrial ecosystems, from the dry forests of Guanacaste Province to the rain forests of Cartago Province. But it should be equally acclaimed for the mass-nesting arribadas of its olive ridley sea turtles on the beaches of Ostional, the dazzling fishes of Cocos Island, the abundance of waterbirds in Caribbean wetlands of Limón Province, and the splendid diversity of marine invertebrates in both its Pacific and Atlantic waters.

There is another, more important reason why Costa Rica shines so brightly, and it lies in the hearts of its people (Ticos). Most countries that were once biologically rich are now impoverished; riches are easily squandered and lost forever. Costa Ricans are special for having made a unique commitment to catalogue and conserve their biota.

More than any other country, Costa Rica has encouraged both natives and foreigners who want to study and teach about its species and ecosystems. It is renowned for having welcomed institutions such as the Organization for Tropical Studies, which has trained so many of the world's leading tropical biologists, for having commissioned Dr. Rodrigo Gámez Lobo to build INBio, Costa Rica's National Biodiversity Institute, which has done so much to build science into conservation, and for encouraging scientists such as Dr. Archie Carr, the father of sea turtle biology, who taught so many people to apply marine science to conservation. Educating its people about its biodiversity is a strategic investment, ensuring that Costa Rica will remain a rich coast.

For a small nation in a world dominated by giants, maintaining biological wealth is a struggle when people hear the seductive calls of free trade, bigger houses, cars, appliances, electronics and fancy clothes. But Costa Rica is unique in insisting that its biodiversity is essential to its national economy and the future of its people. It towers above larger nations in its devotion to peaceful democracy and conservation. Rather than amassing military forces to threaten their neighbors, Ticos preserve a substantial portion of their biological legacy in national parks and other protected areas. In providing safe havens for both parrots and parrotfishes, Costa Rica has

shown greatness of vision and wisdom as wise.

Costa Rica discovered far earlier experience a diversity of life as the Pacific Northwest. As other nations for economic development, Ticos tried sums to see miraculous wildlife. Maintaining biodiversity, as from the essential foundation of Costa Rica, led to meet several world leaders including US Presidents Jimmy Carter and Bill Clinton. In a discussion with President Figueres, I understood the importance of biodiversity.

No country has a perfect conservation of late. Of course I'd like to see sharks and other large fishes in the support goes toward preventing and olive ridley sea turtle nests. could harm the places they come to death. But Ticos have reason of their beautiful marine waters.

Now we have something more biodiversity of a Central America provides the basis for assessing which range of taxa, including some region. I suspect it will be a crucial

Life on Earth is a gift that man. But it is a far more enduring gift. In staking its future on protection, Costa Rica ranks among the very brightest of books long needed by marine biologists. You savor the writing, facts, ideas, both a country consciously protecting the scientists who are working

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shown greatness of vision and wisdom. I wish that other nations, including my own,  
 were as wise.

Costa Rica discovered far earlier than other nations that people would come to  
 experience a diversity of life as exceptional in our world as a starry winter night in  
 the Pacific Northwest. As other nations destroyed their biological heritage in exchange  
 for economic development, Ticos realized that growing numbers would pay substan-  
 tial sums to see miraculous wildlife and ecosystems that were once more widespread.  
 Maintaining biodiversity, as former President José María Figueres once told me, is  
 the essential foundation of Costa Rica's economic development. I have been privi-  
 leged to meet several world leaders who did very good things for our environment,  
 including US Presidents Jimmy Carter and Bill Clinton. But never before or since my  
 discussion with President Figueres have I met a nation's leader who so thoroughly  
 understood the importance of biodiversity to his people's well-being.

No country has a perfect conservation record, including my country, especially  
 of late. Of course I'd like to see Costa Rica give much stronger protection to the  
 sharks and other large fishes in its waters. Of course I'm troubled that little govern-  
 ment support goes toward preventing poaching of endangered leatherback, green  
 and olive ridley sea turtle nests. And of course I'm concerned that too many tourists  
 could harm the places they come to see, essentially loving vulnerable ecosystems  
 to death. But Ticos have reason to be proud as they work to strengthen protection  
 of their beautiful marine waters, as they have their beautiful landscape.

Now we have something more to celebrate: the first book to document the marine  
 biodiversity of a Central American country. It tells us what is known to date, and pro-  
 vides the basis for assessing what needs to be known in the future. It covers a broad  
 range of taxa, including some that have seldom been examined carefully in this  
 region. I suspect it will be a crucial reference for many decades to come.

Life on Earth is a gift that many people overlook as we conduct our daily affairs.  
 But it is a far more enduring gift than so many of the things that we seek to acquire.  
 In staking its future on protecting its diversity of life, on land and in the sea, Costa  
 Rica ranks among the very brightest stars in conservation. Now we have the kind  
 of book long needed by marine scientists working there and in nearby countries. As  
 you savor the writing, facts, ideas and images in this book, I invite you to celebrate  
 both a country consciously protecting its living things as the path to its future, and  
 the scientists who are working to detail its biological wealth.

Elliott A. Norse  
 President of Marine Conservation Biology Institute  
 Bellevue, Washington, USA