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Introductory Chapter: Introduction to Corals in a Changing World

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<http://dx.doi.org/10.5772/intechopen.73868>

1. Introduction

1.1. Corals and coral reefs

Corals have taken about 200–300 million years of evolution to reach the way we currently know them. They are mostly polypoid colonial marine invertebrates belonging to the phylum Cnidaria in the subclasses, Hexacorallia (having six tentacles and mesenteries or multiple mesenteries thereof) and Octocorallia (with eight tentacles and eight mesenteries), both included in the class Anthozoa [1, 2]. They are sessile organisms, which have developed unique form of symbiosis to be successful in complex marine environments. This complex biological assemblage is known to be composed of the coral, its endolithic algae (zooxanthellae), and the associated community of microorganisms including bacteria, archaea, viruses, and fungi. The plant host contributes with nitrogenous waste and receives photosynthetic products from the symbiont in return. Additionally, the association between plants and animals also contributes to the brilliant colors of corals.

1.2. Geographical distribution

Those marine animals composed by millions of tiny polyps have evolved in such extraordinary way that they construct through excretion of calcium carbonate, truly underwater cities (coral reefs) being homes for numerous invertebrate and fish species. The number of species harboring these coral reefs is so high that many people consider them as hotspots of biodiversity. Corals are distributed worldwide in the oceans in shallow and deep waters, but reef-building corals are only limited to shallow waters in tropical and subtropical areas; their

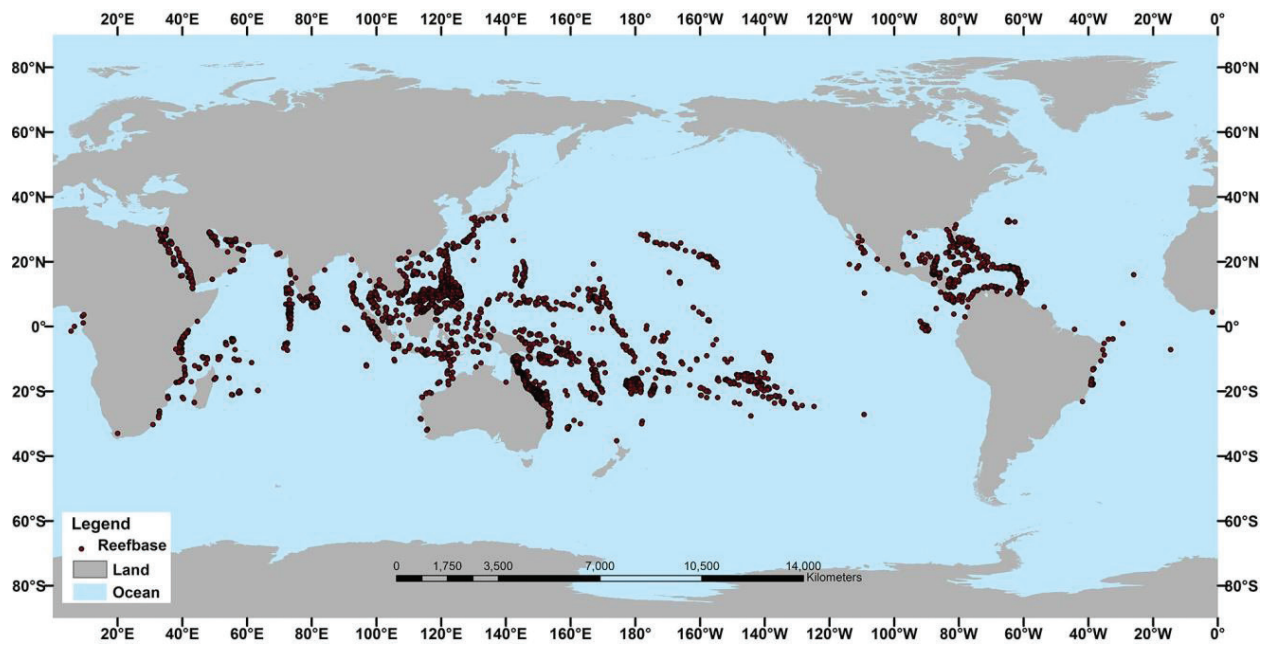


Figure 1. Major coral reef regions of the world as presented in the website: <https://aamboceanservice.blob.core.windows.net/oceanservice-prod/education/kits/corals/media/coralreefmap.jpg> [accessed 2018-01-08].

symbionts, particularly the photosynthetic algae, called zooxanthella, the main producer of energy, needs light and warm temperatures (generally no lower than 20°C) to provide up to 98% of the nutritional needs of this unique marine organism. In addition, coral reefs are the only living structure to be visible from space (**Figure 1**) being within the jurisdiction of more than 100 countries and occupying more than 600,000 km² of tropical oceans.

1.3. Benefits that corals provide and current threats

Furthermore, coral reefs are important ecosystems that harbor many aquatic animals, food sources of superior organisms (they give almost to one quarter of all ocean species, food, and shelter), and commercial and sports fishing for humans. They also provide substantial ecological and economic services to coastal communities. However, they are highly susceptible to natural and anthropogenic threats.

Although in the last two decades, deterioration in coral environments worldwide has been documented, due mainly to the interaction of anthropogenic and climatic stress factors through observation of changes in coral composition, coral bleaching, mass mortality of reef organisms, reduction in the number of coral species, and coral reef coverage, among others; large-scale information on the current state of the reefs is not up to date. As a result, there is no certainty about the actual degree of their status or the degree of recovery or if, on the contrary, the degradation has continued. Nowadays, it is of general consensus that to provide scientific knowledge has become an international priority to make possible their conservation and the reduction of the damages suffered.

Thus, not only due to the undeniable importance of corals but also due to its continuous anthropogenic exploitation, climate change, and other threats such as strong El Niño Oscillation events, ocean acidification, and ecological aspects that have caused the increase of algae and cyanobacteria competitors in affected coral reefs, we have considered of strategic importance to present this book. Furthermore, knowledge on corals is now an international priority to implement effective management and proper conservation measures.

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