

Editorial

# The Extraordinary Importance of Coral-Associated Fauna

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**Abstract:** Coral reefs are one of the most diverse marine ecosystems on Earth and one of the richest in terms of species interactions. Scleractinian corals are usually the most likely to provide numerous different habitats and to support many symbiotic relationships. However, many other invertebrate groups, such as sponges, bryozoans, and other cnidarians, establish strict symbiotic relationships with other marine organisms. Despite the nature of these relationships—as well as the factors that drive their establishment—being unclear in most cases, a few studies have already shown that some associations may increase the resistance of their hosts to external disturbances. Thus, the potential ability of each member of these diverse symbiotic assemblages to influence the fitness and long-term survival of their hosts bring the coral-associated fauna to the top of the list of coral reef studies. Unfortunately, the widespread degradation of coral reef ecosystems may threaten the existence of the intimate relationships that may go unrecognized complicating our understanding of the intricate networks connecting the fates of reef species. Therefore, this unprecedented loss of biodiversity calls for synergic conservation and monitoring actions aimed at significantly increasing our efforts to search for and describe as much of the diversity of coral-associated organisms as possible, shedding new light on the complex, elusive mechanisms controlling coral reef functioning.

**Keywords:** biodiversity; scleractinian; coral reefs; symbiosis; global change; impacts

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Coral reefs encompass the highest biodiversity of any marine ecosystem of the planet [1]. This abundance is primarily due to the topographic complexity created by many benthic organisms, such as reef-building corals, sponges, bryozoans and other cnidarians that play a key role in creating the complex three-dimensional architecture of coral reef and providing a plethora of habitats to support an extraordinary diversity of organisms from all kingdoms of life [2].

The highly diverse fauna associated with these sessile reef organisms is dominated by invertebrates, belonging to numerous phyla—such as Arthropoda, Mollusca, Echinodermata, Anellida, Porifera and Cnidaria—depending on their hosts for food, refuges and habitats, and usually establishing strict symbiotic relationships in form of mutualistic, commensalistic and parasitic associations [3,4]. The coral-associated fauna assumes a considerable and unique importance considering that each member of these diverse symbiotic assemblages has the potential to influence the fitness and long-term survival of their host [2].

Reef-building corals, for example, are known to form associations with about a thousand of micro- and macro-organisms that, in many cases, appear to be strictly host specific. Despite the fact that the large number of them may contribute to the reduced health and mortality of corals through feeding or boring activities, many other species can be considered fundamental to the persistence and resilience of their host corals [4]. Indeed, more than 50% of coral-associated invertebrates are obligate coral dwellers,

with some of them known to actively participate in nutrient recycling [5], to alleviate detrimental effects of sedimentation and actively defend colonies from coral-feeding organisms [6,7], or to slow down the progression of diseases as shown by the crabs of the genus *Cymo* [8]. More recently, coral symbiotic hydrozoans of the genus *Zanclaea* has been proved to both reduce coral susceptibility to diseases and protect their hosts from predation [9], highlighting how far we are from the understanding of the mechanisms by which ecological interactions can mediate species' responses to disturbances.

Unfortunately, how many species are living on the coral reefs as well as the species of micro- and macroinvertebrates living in association with other reef organisms is still not clear. Most of the unknown reef communities consist of cryptofauna [10] that may be difficult to recognize in the field due to their tiny size [11,12], camouflage behavior [13,14], and because they live in habitats that are often overlooked, such as caves, sediment or coral rubble [15], or because they are located in deep environments as the mesophotic zones [16]. This gap in knowledge can be exacerbated both in shallow and deep coral reefs if the parasites diversity is included since most species in most major parasite groups are still undiscovered or unnamed [17].

Bearing in mind the likely high degree of specialization and co-dependence of these symbiotic relationships, this lack of information appears dramatic in the light of the increasing number of threats contributing to the global decline of coral reefs [18]. Indeed, habitat degradation could have serious negative effects on the diversity of reefs and may disrupt these symbiotic relationships [19], intensifying the loss of biodiversity [20]. Thus, if preserving biodiversity is now considered a priority for any natural ecosystem, it is increasingly vital for the future of coral reefs in which thousands of coral-associated organisms could be negatively impacted by global change, on scales ranging from local declines to global extinction; these losses could have major downstream consequences for coral reef ecosystem function and stability [17].

The fundamental value of the papers published in this Special Issue is twofold. On one hand, it highlights the still-scarce knowledge of the ecological interactions in tropical coral reef ecosystems and the possible existence of many other so-far-unknown similar associations that deserve our attention. On the other hand, it highlights how the combination of multidisciplinary approaches, taxonomic expertise and dedicated biodiversity surveys can significantly improve our knowledge about the diversity, ecology and role of coral-associated fauna. Therefore, we hope that these studies can stimulate the exploration of neglected areas in reef ecology, increase significantly our effort in searching and describing as much the diversity of coral-associated organisms and systematically investigate the coral-associated biodiversity by adding coral-associated fauna surveys to largescale biodiversity monitoring programs.

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