

Editorial

# Editorial for Special Issue “Meiofauna Biodiversity and Ecology”

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**Abstract:** Meiofauna are a component of aquatic environments from polar to tropical regions. They may colonize all types of habitats and include very enigmatic and exclusive taxa. The biodiversity of this component in marine ecosystems is far from being accurately estimated, but this would be a new challenge given the importance that meiofaunal components may play in marine ecosystem functioning and processes. This Special Issue collects many interesting topics in research on meiofauna contributing to plugging a gap on several key issues in their biodiversity, distribution, and ecology, from numerous regions that include the USA, Brazil, French Guiana, Costa Rica, Mexico, Cuba, Italy, Kuwait, Vietnam, Madagascar, the Maldives, and South Korea.

**Keywords:** biodiversity; ecology; taxonomy; DNA barcoding; new species; epibiosis;  $\beta$ -diversity; biological traits; bioindicators; meiofauna paradox

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Meiofauna are small organisms (body size range: 30–500  $\mu\text{m}$ ) that inhabit seabeds all over the world, even the most extreme ones [1–3]. They live in and on all types of marine substrata as well as on other living organisms from invertebrates to vertebrates. Twenty-four of the 35 animal phyla have at least one representative within meiofauna. In a handful of sediment or in a few square centimeters, we can find many different meiofaunal species, with the most varied and curious forms, that share peculiar lifestyles, ecological relationships, and evolutionary traits [1]. Thanks to their remarkable abundance and biodiversity, their rapid life cycle, and their metabolic rate, they contribute significantly to the processes and functioning of marine ecosystems [4]. Some taxa have also revealed considerable utility in the evaluation of the ecological quality of coastal marine sediments in accordance with European Directives 2000/60/CE and MSFD 2008/56/CE, e.g. [5,6]. Therefore, understanding the distribution patterns of their biodiversity and identifying the factors that control it at a global level is of great importance.

Current estimates of the meiofaunal biodiversity level are significantly lacking. There are authors who even hypothesize that some meiobenthic phyla could have the same level of biodiversity magnitude as insects in terrestrial habitats [7]. Unfortunately, the minute morphological characterizations utilized for the taxonomical identification of these taxa, the suite of necessary classification skills, and the general increase in taxonomic crisis that still discourages many young researchers from field taxonomy have notably hampered advances in this field of interest. This Special Issue also assumes additional considerable importance if we consider the crucial role that the terrestrial nematode *Caenorhabditis elegans* has held in the history of biology in the last few decades. In fact, this benthic species could represent an

important tool not only for the monitoring and conservation of marine ecosystems, but also as a hidden treasure trove of new natural products that could represent an advance in the biomedical sector.

Accordingly, the purpose of this Special Issue was to bring together researchers from around the world to share their most recent studies on some important themes in meiofaunal biodiversity and ecology. Many people replied to the Special Issue call from the USA, Brazil, Costa Rica, Mexico, Cuba, Italy, Belgium, France, Denmark, Russia, Kuwait, Vietnam, and South Korea. This was certainly an additional opportunity to build a more solid network among experts in this field and contribute to increasing the visibility of these tiny organisms.

The manuscripts published in this Special Issue cover not only topics in the traditional morphological taxonomy of meiofaunal groups (Gastrotricha: [8]; Nematoda: [9]; Copepoda: [10,11]), but also studies combining both morphological and molecular approaches (Gastrotricha: [12]; Nematoda: [13]).

The occurrence of meiofaunal taxa in a wide spatial range is often a mystery because they do not have pelagic larvae. Some hypotheses have been formulated in the past see [1] and references therein, but Ingels and co-authors raise some new and interesting insights to explain the so-called “meiofauna paradox” thanks to a study on the meiofaunal epibionts of loggerhead sea turtles [14]. However, meiofaunal organisms may be themselves a substratum for other smaller benthic groups (i.e., bacteria or ciliates); in simple terms, biodiversity within biodiversity! In this respect, an extensive review is included on the ciliate and nematode epibiosis phenomenon with a description of three new epibiont species and an updated distribution of all the records of nematode-suctorina association around the world [15]. As reported above, it is fundamental to identify the factors that control meiofaunal distribution patterns in marine ecosystems under both natural and anthropogenic gradients. Indeed, the relationship between organic matter, prokaryotes, and meiofauna across a river-lagoon-sea gradient is investigated in [16]. The role of habitat on the diversity patterns of nematodes in the Cuban archipelago is also evaluated, taking into consideration not only  $\beta$ -diversity but also biological traits [17]. Biological traits, if adequately addressed, could represent an additional approach for the detection of environmental changes [18]. Hard substrata may host a highly diversified meiobenthic community, but overall, a limited number of papers are present on this habitat type see [19] and references therein. Gallucci et al [20] further demonstrate, based on work in south-eastern Brazil, that substrate identity and the surrounding environment are important in structuring smaller meiofauna, particularly the nematodes. In the Mekong delta system (Vietnam), biochemical component changes due to dam construction have been investigated revealing a nematode assemblage that has adapted well to organic enrichment, heavy metal accumulation, and oxygen depletion, but the dam located in the Ba Lai estuary may potentially continue to drive this ecosystem to its tipping point, underlining the need for further investigations [21]. Foraminifera may become a consistent part of meiobenthic communities in marine and transitional environments [22]. Al-Enezi et al [23] document for the first time the biodiversity pattern of benthic foraminifera from Kuwait Bay and the northern islands in this area.

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