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Editorial

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Arctic Deep-Sea Epi-fauna Using a Biological Traits Approach

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Introduction

In contrast to shallower marine ecosystems, the deep sea is generally thought to be a more stable environment with constantly low bottom water temperature typically, but down to sub-zero values in the Arctic, high pressure, and low current velocity and re-suspension. More than the sea floor is covered by visually homogeneous abyssal plains, interrupted by geological structures such as ridges, canyons, hydrothermal vents, and cold seeps that add substantial heterogeneity to the habitat, biota and processes [1]. Deep-sea benthic communities are driven to a large extent by the amount of energy provided to the system from surface production. Only the surface production typically reaches the deep-sea floor and by that time is dominated by heavily reworked detrital organic material [2]. Food limitation is particularly extreme in the central Arctic basins where the high latitude and seasonal or permanent sea ice control light penetration into the upper water column, and stratification limits the availability of nutrients during the short productive seasons [3]. Consequently, primary production in the oligotrophic Arctic basins is low with low levels of vertical flux of generally below depth, and often less than half of that reaching the deep-sea floor. These levels are considerably lower than other deep-sea areas, where pelagic primary production is highly variable, but often exceeds. Environmental conditions shape the biological characteristics of deep-sea benthic communities. Early studies suggested that benthic associations governed by constantly limited food availability are composed of small individuals on the average [4]. Indeed, recent studies confirmed that organisms of comparatively smaller size dominate at greater depth, though organisms of all sizes can inhabit the benthic environment in the deep sea. Low food availability and quality on the deep-sea seafloor, and low ambient current velocity are typically reflected in high proportions of deposit feeding fauna. While suspension feeders, predators and scavengers are also represented in the deep sea, suspension feeders tend to be less frequent due to the generally low currents and thus low amount of suspended materials and low frequency of predators likely is due to low densities of prey. In addition, scarce food may result in a dominance of mobile taxa that are more efficient in finding food than sessile taxa that can only be supported in regions with enough particle flux and stronger currents [5]. Both pioneering and recent studies suggested that deep sea benthic fauna present a rich assortment of reproductive modes and life-history traits, including direct development, brooding, lecitho-trophic, and plankto-trophic larvae [6]. In summary, based on the current literature, the general view of the typical deep-sea fauna is one of taxa of small size, non-sessile, often deposit feeding and developing either directly or indirectly. These and other biological characteristics of species also referred to as traits, can be used to assess ecosystem functioning, that is the maintenance and regulation of ecosystem processes, including organism-environment interaction [7]. Seafloor fauna are heavily involved in ecosystem processes such as consumption and transfer of organic matter to higher trophic levels, organic matter decomposition, nutrient renewal, productivity and habitat provision [8]. These processes depend, directly or indirectly, on morphological, behavioural and life history traits that species exhibit in a community. Thus, an assessment of these traits can provide a deeper insight into functional structure and variation than is possible with a taxonomic description of a community alone. Biological trait analysis can assess functional characteristics of a given community as well as ecosystem vulnerability through metrics such as functional diversity i.e., diversity of trait categories called modalities, and functional redundancy i.e., a measure of the degree to which species exhibiting the same trait modalities [9]. Studies investigating Arctic ecosystem function using the BTA approach have advanced our understanding of functional structure of benthic communities mostly on the shelves and for macrofauna, while few studies have so far focused on biological traits of epi-faunal mega-fauna i.e., invertebrates and demersal fish on top of the sediment and typically or deep ecosystems [10].

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Conflict of Interest

None

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