

{rokbox title=|Images showing the diversity of Vulnerable Marine Ecosystems, including cold-water coral reefs, coral gardens and sponge grounds, at different locations across the North Atlantic Ocean :: Image: Authors| thumb=|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-influence-water-masses-biodiversity-biogeography-deep-sea-benthic-ecosystems-north-atlantic-puerta-et-al-2016-thumb.jpg|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-influence-water-masses-biodiversity-biogeography-deep-sea-benthic-ecosystems-north-atlantic-puerta-et-al-2016.jpg{/rokbox}

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Influence of Water Masses on the Biodiversity and Biogeography of Deep-Sea Benthic Ecosystems in the North Atlantic

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Abstract: Circulation patterns in the North Atlantic Ocean have changed and re-organized multiple times over millions of years, influencing the biodiversity, distribution, and connectivity patterns of deep-sea species and ecosystems. In this study, we review the effects of the water mass properties (temperature, salinity, food supply, carbonate chemistry, and oxygen) on deep-sea benthic megafauna (from species to community level) and discussed in future scenarios of climate change. We focus on the key oceanic controls on deep-sea megafauna biodiversity and biogeography patterns. We place particular attention on cold-water corals and sponges, as these are ecosystem-engineering organisms that constitute vulnerable marine ecosystems (VME) with high associated biodiversity. Besides documenting the current state of the knowledge on this topic, a future scenario for water mass properties in the deep North Atlantic basin was predicted. The pace and severity of climate change in the deep-sea will vary across regions. However, predicted water mass properties showed that all regions in the North Atlantic will be exposed to multiple stressors by 2100, experiencing at least one critical change in water temperature (+2°C), organic carbon fluxes (reduced up to 50%), ocean acidification (pH reduced up to 0.3), aragonite saturation horizon (shoaling above 1000 m) and/or reduction in dissolved oxygen (>5%). The northernmost regions of the North Atlantic will suffer the greatest impacts. Warmer and more acidic oceans will drastically reduce the suitable habitat for ecosystem-engineers, with severe consequences such as declines in population densities, even compromising their long-term survival, loss of biodiversity and reduced biogeographic distribution that might compromise connectivity at large scales. These effects can be aggravated by reductions in carbon fluxes, particularly in areas where food availability is already limited. Declines in benthic biomass and biodiversity will diminish ecosystem services such as habitat provision, nutrient cycling, etc. This study shows that the deep-sea VME affected by

contemporary anthropogenic impacts and with the ongoing climate change impacts are unlikely to withstand additional pressures from more intrusive human activities. This study serves also as a warning to protect these ecosystems through regulations and by tempering the ongoing socio-political drivers for increasing exploitation of marine resources.

Keywords: North Atlantic, deep-sea, biodiversity, biogeography, water masses, vulnerable marine ecosystems