**Significance statement**

In this study, we investigated global biogeographical regions extending from shallow marine waters to the largest, yet least explored habitat on Earth, the deep sea. Our objective was twofold. First, delineate for the first time the global bioregions of ophiuroids using a biogeographical network approach. Second, test with models how region boundaries are predicted by tectonic plates and contemporary environmental variables in order to derive hypotheses on the processes that shaped these regions from shallow water to the deep sea. These findings push forward the field of macroecology, because we are able to characterise biogeographical patterns and test mechanisms that generate them in the deep ocean, using distribution data of a less well known taxon. This study will be of interest for a wide audience since it addresses multiple aspects of biogeography and macroecology at the global scale (bioregionalisation, drivers of distinctiveness among faunas) and applies methods, which can be transferred to all types of ecosystems. The current study builds upon previous biogeographical work by Tim O’Hara in the deep-sea. Our study utilises novel analyses (networks) to generate larger benthic bioregions, but also illustrating transition regions and displaying the faunal connections between the bioregions. Furthermore, in this study we expand quantitatively our understanding of processes that have created benthic bioregions extending from coastal waters to the deep-ocean.

**Data archiving statement**

The ophiuroid distribution dataset and scripts used in this study are available at DOI:10.5281/zenodo.7656699.

**Conflict of interest statement**
There is no conflict of interest.

**Ethics statement**

**Details of ophiuroid voucher specimens located at the** Muséum national d'Histoire naturelle **are available in the supplementary material in Table 3.** The ophiuroid distribution dataset and scripts used in this study are available at DOI:10.5281/zenodo.7656699.

**Funding statement**

The Census of Marine Life provided funds to TOH to complete the ophiuroid dataset. LV and JD were funded by the LABEX BCDiv (ANR-10-LABX-03) grant, which also supported the latest cruises of the Tropical Deep-Sea Benthos program namely KANACONO (10.17600/16003900), KANADEEP1 (10.17600/17003800) and PAPUA NIUGINI (10.17600/18000841)) that enriched the dataset. LV was also further funded by the Norwegian Research Council project number 287934.

**Acknowledgements**

The authors would like to express their gratitude towards the Tropical Deep-Sea Benthos exploration program and the associated cruises and taxonomists, which have been instrumental in gathering biodiversity data (https://expeditions.mnhn.fr/program/tropicaldeep-seabenthos). LV would like to thank Dr. Marine Robuchon and Dr. Eric Pante for useful discussions, which contributed towards the manuscript. All authors thank the three anonymous reviewers whose comments improved the manuscript significantly.