

ID: W2205353295

TITLE: The Antarctic Circumpolar Current as a diversification trigger for deep-sea octocorals

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ABSTRACT:

Background: Antarctica is surrounded by the Antarctic Circumpolar Current (ACC), the largest and strongest current in the world. Despite its potential importance for shaping biogeographical patterns, the distribution and connectivity of deep-sea populations across the ACC remain poorly understood. In this study we conducted the first assessment of phylogeographical patterns in deep-sea octocorals in the South Pacific and Southern Ocean, specifically a group of closely related bottlebrush octocorals (Primnoidae: Tokoprymno and Thourella), as a test case to study the effect of the ACC on the population structure of brooding species. We assessed the degree to which the ACC constitutes a barrier to gene flow between northern and southern populations and whether the onset of diversification of these corals coincides with the origin of the ACC (Oligocene-Miocene boundary). Results: Based on DNA sequences of two nuclear genes from 80 individuals and a combination of phylogeographic model-testing approaches we found a phylogenetic break corresponding to the spatial occurrence of the ACC. We also found significant genetic structure among our four regional populations. However, we uncovered shared haplotypes among certain population pairs, suggesting long-distance, asymmetrical migration. Our divergence time analyses indicated that the separation of amphi-ACC populations took place during the Middle Miocene around 12.6 million years ago, i.e., after the formation of the ACC. Conclusion: We suggest that the ACC constitutes a semi-permeable barrier to these deep-sea octocorals capable of separating and structuring populations, while allowing short periods of gene flow. The fluctuations in latitudinal positioning of the ACC during the Miocene likely contributed to the diversification of these octocorals. Additionally, we provide evidence that the populations from each of our four sampling regions could actually constitute different species.

SOURCE: BMC evolutionary biology

PDF URL: <https://bmcevolbiol.biomedcentral.com/track/pdf/10.1186/s12862-015-0574-z>

CITED BY COUNT: 33

PUBLICATION YEAR: 2016

TYPE: article

CONCEPTS: ['Phylogeography', 'Circumpolar star', 'Biology', 'Biogeography', 'Gene flow', 'Vicariance', 'Population', 'Ecology', 'Deep sea', 'Oceanography', 'Evolutionary biology', 'Phylogenetic tree', 'Geology', 'Genetic variation', 'Fishery', 'Gene', 'Biochemistry', 'Demography', 'Sociology']