

Landscape Mapping At Sub-Antarctic South Georgia Provides A Protocol For Underpinning Large-Scale Marine Protected Areas

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Global biodiversity is in decline. Anthropogenic activities act as drivers of this decline, with the marine environment experiencing significant and increasing pressure from extractive industries such as fishing, marine deposit mining, and oil and gas extraction, activities, which are increasingly proliferating into deep sea environments. Under financial, political and social constraints however, one of the key questions that precede any conservation strategy, is how and where to prioritise limited resources and effort to maximise conservation payoff in an increasingly exploited, yet still poorly understood marine environment. Over the past decade, marine protected areas (MPAs) have increasingly been adopted as the flagship approach to marine conservation, many covering enormous areas of over one million km². At present however, the lack of scientific biological sampling makes understanding and prioritising which regions of the ocean to protect, especially over large spatial scales particularly problematic.

Here, we present an interdisciplinary approach to marine landscape mapping at the sub-Antarctic island of South Georgia, as an effective protocol for underpinning large-scale MPA designations. South Georgia forms part of one of the largest MPAs in the world and supports a highly biodiverse benthic fauna. We developed a new high-resolution (100m) digital elevation model (DEM) of the region and integrate this DEM with bathymetry derived parameters (e.g. rugosity, slope gradient), modelled oceanographic data (e.g. seabed temperature, salinity and currents) and satellite net primary productivity data. These interdisciplinary datasets were used to apply an objective statistical approach to hierarchically partitioning and mapping the benthic environment into distinct ecologically-relevant physical habitats. Using this benthic marine landscape map and overlaying it with a regional biological dataset we aim to assess the application of physical habitat classifications as proxies for biological structuring and as such the application of the landscape mapping protocol for informing on marine spatial planning.