Exploring how seascape dynamics structure genetic variation in the Scotia Sea
Final report to Antarctic Science Ltd

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Project overview

Understanding how ecology, environmental, and geographic features structure population genetic patterns provide crucial insights into the species evolutionary history, as well as their vulnerability or resilience under climate change. It is known that the circumpolar and regional seascape dynamics in the Southern Ocean influence population genetic variation differently across spatial scales. However, comprehensive analyses testing for the relative importance of different environmental and geographic variables on genomic variation, across these scales, are generally lacking in the Southern Ocean.

The funding from Antarctic Science Ltd allowed me to perform specialised target capture sequencing to retrieve genome-wide data in degraded biological samples. In this project, I examined the genome-wide single nucleotide polymorphisms of the Southern Ocean octopus *Pareledone turqueti* across the Scotia Sea and the Antarctic continental shelf, at depths between 102 – 1,342 m, throughout most of the species' distribution. I found that the circumpolar population structure of *P. turqueti* is biogeographically structured with clear signature of isolation-by-geographical distance, but long-distance genetic connectivity was also detected between East and West Antarctica. Genomic variation of *P. turqueti* was most significantly linked to bottom water temperature at circumpolar scale. However, geographical distance and isolation-by-water depth were the only significant drivers of genomic variation at regional scale within the Scotia Sea. Genotype-environmental association was also detected between warmer temperatures and South Georgia/Shag Rocks, with putative positive selection of hemocyanin (oxygen transport protein) indicated, suggesting possible physiological adaptation to warmer temperatures around sub-Antarctic localities. Critically, I identified seascape drivers of genomic variation in the Southern Ocean at circumpolar and regional scales in *P. turqueti* and contextualised the roles of environmental adaptations in the species evolutionary history.

Direct outcomes from the Antarctic Science Bursary

I am currently preparing a manuscript on how seascape dynamics influence genomic variations of *P. turqueti* in the Scotia Sea and across the Southern Ocean. I have also submitted an abstract on seascape dynamics in the Scotia Sea for oral presentation at an

international conference. Additionally, I also developed two other studies, on topics of bioinformatic pipeline and species evolutionary histories in the Southern Ocean, based on the data generated using the funds from the 2019 Antarctic Science Bursary. These studies are currently being finalised and I plan on writing them as manuscripts in the coming months.

I would like to sincerely thank the Board of Antarctic Science Ltd for awarding me the 2019 Antarctic Science Bursary.