

COPE

Conservation management of polar ecosystems: using genomic approaches to study connectivity

DURATION
 15/12/2019 - 15/03/2024

BUDGET
 511 734€

PROJECT DESCRIPTION

Context:

Polar ecosystems harbor a unique cold-adapted biodiversity that is threatened by rapid environmental change and increasing anthropogenic impact. Environmental and biological information being scant, multi-scale data on connectivity and adaptation are essential for supporting exploitation and conservation management of living resources and ecosystems. In the Southern Ocean, the second of several planned large Marine Protected Areas (MPA) has recently been set up. MPAs are most effective if implemented as a network that considers functional diversity within and between species, relying on scale-dependent connections between MPAs. Three key features of connectivity are important in this context: 1) geographic or landscape connectivity, 2) environmental or habitat connectivity, and 3) genetic connectivity. While knowledge on geographic bio-regionalisation is fairly well-advanced, in-depth estimates of environmental and genetic connectivity need further development.

General objectives and underlying research questions:

The goal of the COPE project is to understand the functional connectivity of benthic and pelagic ecosystems in the Southern Ocean. We use an integrated multiscale approach of space and adaptation to develop niche models in support of Belgian policy on Marine Protected Areas in the Polar Regions. We will address the following research questions:

- (1) Do *Trematomus* fish and Eusiroidea amphipods show genetic structures linked to the geography of the Southern Ocean?
- (2) Are there outlier loci of the *Trematomus* fish and Eusiroidea amphipod genomes pointing to environment-specific adaptations?
- (3) Do life history (including dispersal) and oceanic seascape (including current systems) determine connectivity in *Trematomus* fish and Eusiroidea amphipods?
- (4) Is the current niche of *Trematomus* fish and Eusiroidea amphipods fully realised?
- (5) Will the future niche of *Trematomus* fish and Eusiroidea amphipods will shift under influence of climate change?



Methodology:

The overarching aim of COPE is to assess adaptation and connectivity of ecologically important taxa of Antarctic pelagic and benthic ecosystems for developing sustainable conservation measures. Acquisition of samples, estimates of genome sizes, reduced representation sequencing and *de novo* genotype calling, and species distribution modeling are the key methods.



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Potential impact of the research:

COPE will have a large impact on science, and management and conservation of Antarctic biodiversity. Given the public fascination with the Antarctic continent, the project will also significantly impact society and culture. Most importantly, the project will provide a unique framework of information on the abiotic and biotic factors driving current and future distribution patterns of Antarctic key benthic species. This information can be directly applied in conservation and science policy activities in CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources) and form the basis for the establishment of new Marine Protected Areas.

Description of the expected final research results:

COPE will generate biological distribution data, novel genomic data on the adaptation and connectivity of endemic species from the Southern Ocean, new species distribution models incorporating genomic results, and future scenarios of species distributions under climate change. The results of COPE will be valorised through scientific publications submitted to open source publishers, and presentations at scientific meetings and conferences. Beyond the scientific community, the results of COPE will also be valorised by communication to committees on conservation, management and science policy of the Antarctic, to NGOs like WWF and OCEANA, and to the general public and education institutions. Of foremost importance will be the immediate and direct presentation of the COPE results to CCAMLR for the establishment of MPAs.

All the primary data produced by the project will be made openly available in accordance with Article II.1.c of the Antarctic Treaty, within the shortest timing achievable. Data will be valorised by submission to established data standards and databases: e.g. DARWIN at the RBINS, and public databases like GenBank, BOLD, OBIS, GBIF and biodiversity.aq. Also, all models will be made openly available.



CONTACT INFORMATION

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