RECTO

Refugia and ecosystem tolerance in the Southern Ocean

PROJECT DESCRIPTION

Context

Because of its long history and geographic isolation, the Southern Ocean (SO) provides a natural laboratory for research on evolution and biodiversity. Confronted with fast-paced environmental changes, the organisms in Antarctic ecosystems are strongly challenged and face three possible outcomes: adaptation, migration or extinction. Past glaciation periods have already forced marine zoobenthos of the SO into refugia, being either ice-free continental shelf areas, the deep sea or sub- or peri-Antarctic regions, followed by recolonization when the ice retreated. RECTO will strive at understanding how such past events have driven diversification and adaptation in different animal groups and how these can be applied as proxies to understand the contemporary situation and predict future scenarios. In a multidisciplinary approach, RECTO will focus on six different animal groups, comprising different trophic levels from the micro- over macro-benthos and pelagic crustaceans to fish and seabirds. The selected species differ in their biology, life history traitss and dispersal capacities, which are all factors affecting their abilities to cope with environmental changes.

General objectives and underlying research questions

RECTO will assess the adaptive capacities of key taxa to future climate change in the SO with the following six objectives:

1. Reconstruct population histories and phylogenies of selected faunas
2. Link population histories and refugia to past climate changes
3. Estimate variation of morphological traits and width of ecological niches
4. Use physiological and energy limits and traits to model current and future species distributions
5. Integrate distribution models into hydrodynamic and particle models
6. Develop different scenarios on how target taxa will respond to future climate change

Methodology

With a molecular approach, RECTO will produce data to infer population histories and Pleistocene refugia and test for possible correlations with past climate data to reconstruct how the target taxa responded to past glaciations and interglaciations. With phenotypic and trophic data, RECTO will also study in a novel phylogenetic framework how diversification and adaptability are interacting with each other and whether ecotypes of selected species have faster modes of evolution. RECTO will simulate environmental changes with physiological experiments and also determine energy budgets of target species. Geographic models of future species and trait distributions (based on physiological and energy limits) as well as present and future climate data will be refined and integrated with coupled sea-ice-ocean and individual based models for the SO. Finally, scenarios of future dispersive abilities and possible habitat shifts of the RECTO target groups will be developed.

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Nature of interdisciplinarity

RECTO is a multidisciplinary research networking, and will integrate results from at least ten research disciplines including taxonomy, genomics, genetics, physiology, evolution, macro-ecology, numerical modelling, geology, geography and oceanography.

Potential impact of the research on science, society and/or on decision making

RECTO is primarily a scientifically oriented research network. but will also have an important impact on policy makers and the society. RECTO will use its scientific results on adaptations of SO faunas to past climate changes to infer how these animals will react to future climate scenarios. In view of global warming, these results have important implications for policy decisions at the national and international level. RECTO will interact with CCAMLR (Commission for the Conservation of Antarctic Marine Life Resources) and the ATCM (Antarctic Treaty Consultative Meeting) and findings of RECTO will be presented at the Scientific Committee at CCAMLR. The involvement of a sub-contractor providing advice on bioeconomic modelling of the Southern Ocean will further valorise the obtained scientific results and open future research avenues. Sustainability and global warming are further topics that increasingly raise the interest of the general public.

Description of finished products of research at short and medium term

All scientific results and data of RECTO will be valorised and openly disseminated through submission to various public databases, publications in high level open access journals, and presentations at national and international conferences, scientific meetings, and committees. RECTO will produce geographic models on future species and trait distributions that will be integrated with coupled sea-ice-ocean and individual based models for the SO and develop scenarios for future climate change. There will be annual meetings with the follow-up committee and a final workshop at the end of the project as a combined scientific and stakeholder meeting that will be broadly advertised in the international Antarctic research community and among science policy makers, decision makers, and other stakeholders (e.g. EU DG Climate, Federal DG Environment – Climate) at the national and international level.

CONTACT INFORMATION

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LINKS

https://www.naturalsciences.be/en/science/do/98/scientific-research/research-projects/project/6210
https://biomar.ulb.ac.be/projects/recto/