How do Antarctic microbial communities respond to increased glacial melt?

Patrick D. Rozema¹, Anouk M.-T. Piquet¹, Ronald J.W. Visser¹, Amber J. Annett², Hugh J. Venables², Michael P. Meredith² and Anita G. J. Buma¹

¹ Department of Ocean Ecosystems, Energy and Sustainability Research Institute Groningen, University of Groningen, Nijenborgh 7, 9747 AG Groningen, The Netherlands
² British Antarctic Survey, High Cross, Madingley Road, Cambridge, United Kingdom

Introduction
The Western Antarctic Peninsula is warming more rapidly than any other region in the Southern Hemisphere and significant glacial retreat is already reported. Enhanced melting of glaciers results in an increase of freshwater entering the adjacent coastal areas. This affects physical and chemical water properties. Alteration of these marine parameters in the coastal Antarctic waters will most likely affect all Antarctic marine life, either directly or indirectly. In our project we study the impact of enhanced melt water input on basic organisms of the Antarctic marine food chain: the microscopic algae (Fig. 1) and the bacteria.

Phytoplankton and the Antarctic food web
The Antarctic food web is based marine microalgae, also called phytoplankton (Fig. 2), are tiny single celled algae which absorb sunlight for photosynthesis (Fig. 1). During photosynthesis CO₂ is transformed into sugars that fuel phytoplankton growth. Krill, the most important grazer, feast on the extensive phytoplankton blooms and transfer biomass further along the food chain. Changes of the physical parameters in the coastal waters due to e.g. glacial melt will affect which species of phytoplankton will be the most abundant. However, krill prefers specific types of phytoplankton species. Thus, changes in phytoplankton abundance and composition may have large consequences for the whole marine food web.

Bacteria and remineralization
The final link in the food web is composed of bacteria (Fig. 2). Bacteria break down most of the organic matter into re usable compounds necessary for phytoplankton growth. As the phytoplankton species composition changes, so will the type of dead organic matter in the water as different species are composed of slightly different material. This change in organic matter will most likely alter the bacterial species composition.

What do we want to know?
We want to understand the effects of increased freshwater input from glacial melt on:
- Phytoplankton and bacterial community composition
- Productivity of the phytoplankton and bacteria

How do we do it?
During the period of Januari 2013 – December 2014 we will collect a multitude of water samples from Ryder bay. Most of our samples will be filtered to capture phytoplankton and bacteria for processing in the Netherlands. The phytoplankton and bacterial species will be identified using various molecular techniques (see below). Additionally, other samples will be collected for incubations on Rothera to estimate the productivity, thus to determine how quickly phytoplankton absorb CO₂ for photosynthesis.

Collect water samples and data at Rothera

Collect bacteria and phytoplankton on filters

Extract DNA from bacteria and phytoplankton

Use a molecular fingerprinting technique to understand community dynamics

Identify individual species by sequencing their DNA

Incubate phytoplankton under different light intensities

Calculate CO₂ uptake by phytoplankton

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