On the seasonal development of sea-ice microalgal communities and a forecast for downstream effects of ongoing sea-ice decline

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The Western Antarctic Peninsula (WAP) is one of the fastest warming oceanic regions on earth, with a recorded increase in winter temperature of 6 °C since 1950. Coinciding with the warming of shelf water the amount of sea ice that is formed over winter shows a general declining trend. The consequences of this decline for biogeochemical processes are poorly understood. Microalgal composition and production was studied in sea ice in four consecutive winters from 2013-2016, at Ryder Bay, located at the southern part of the WAP.

Sea ice was sampled over the period of ice formation in autumn until ice melt in spring. Microalgal composition was studied by means of their pigment signature and microscopy; production capacity was studied by fluorescence analyses and C13-incorporation studies. At the onset of ice formation, the sympagic algal communities consisted of a mixture of species. Over the course of winter, heterotrophic flagellates became dominant. In spring, biomass increased strongly in the bottom layers and reached a maximum concentration of more than 700 µg Chl.a l⁻¹ in December 2014. These communities were mainly diatom-dominated. In spring, algal samples were also taken from under ice and pelagic communities. For the first time, we are able to present data that show essential differences in seeding potential of sea ice for diatom and flagellate species. The downstream effects of predicted changes in sea-ice cover and associated ice-algal communities on biogeochemical exchange processes with the marine ecosystem will be discussed.