

Effects of Wind-driven Phytoplankton Communities Shifts on the Western Antarctic Peninsula Ecosystem

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Rapid climate change in the Western Antarctic Peninsula (WAP) has driven foundational shifts in phytoplankton communities by altering physical processes within the water column. As phytoplankton serve as the base of Antarctic food web, changes in their composition may have far-reaching effects on the ecosystem. To evaluate the variability of the phytoplankton community in Marian Cove, WAP, diagnostic pigments were analyzed for CHEMTAX (CHEMical TAXonomy). The dominant phytoplankton groups—diatoms, cryptophytes, and *Phaeocystis* spp. —exhibited shifts in relative contribution depending on zonal wind direction. Easterly winds introduced large (>20 μm) benthic diatoms into the water column, contributing 51% of the total phytoplankton biomass. Nano-sized cryptophytes and *Phaeocystis* spp. accounted for 13% and 3% of total phytoplankton biomass under easterly winds, but their contributions increased to 21% and 16% under prevailing westerly winds. Westerly winds facilitated the influx of nanoflagellates from outside Marian Cove, leading to a reduction in phytoplankton size spectrum. Diatoms and cryptophytes displayed complementary distributions in response to easterly and westerly wind stresses. Notably, the contribution of cryptophytes was significantly correlated with westerly wind stress ($r = -0.50$, $p < 0.01$). This evident correlation suggests a potential increase of cryptophytes under strengthened westerly winds associated with the persistent positive phase of the Southern Annular Mode. The enhanced shifts to cryptophytes in the phytoplankton community strongly indicate the bottom-up effects on the vulnerable WAP ecosystem.