Anomalously low zooplankton abundance in the Ross Sea: An alternative explanation

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ABSTRACT: The southwestern Ross Sea (Antarctica) supports a large bloom of *Phaeocystis antarctica* in the Ross Sea polynya, which is impacted minimally by zooplankton and a smaller diatom bloom in the adjacent Terra Nova Bay polynya, which are more readily grazed. This difference in grazing pressure between the two regions frequently has been explained by a reduced susceptibility of *P. antarctica* to grazing, despite conflicting evidence showing that *Phaeocystis* spp. are readily grazed by zooplankton. Using a three-dimensional ecosystem model of the Ross Sea, our goal was to determine whether phytoplankton growth dynamics, rather than mechanical and/or chemical defenses, might explain (1) the relatively low zooplankton abundance observed in waters dominated by *P. antarctica*, and (2) the low overall zooplankton biomass in the Ross Sea. Although in the model, diatoms and *P. antarctica* were grazed with equal ease (i.e., no prey selectivity), the slower growth of phytoplankton in Terra Nova Bay resulted in a higher degree of phytoplankton-zooplankton coupling and greater zooplankton abundance. Conversely, the exaggerated boom/bust cycle of the *P. antarctica* bloom in the Ross Sea polynya resulted in greater decoupling from higher trophic levels and reduced zooplankton biomass. This indicates that the low zooplankton abundance observed in the Ross Sea polynya may be a consequence of their inability to match the high growth rates of *P. antarctica*. The different degrees of zooplankton-phytoplankton coupling between Terra Nova Bay and the Ross Sea polynya may have important implications for food web structure and carbon export, especially under changing stratification.