Climate change impact on coastal particulate organic matter cycling and nutritional value, using amino acid concentrations and stable isotopes

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Anthropogenic emissions are impacting oceans on a global scale and will alter the structure and functioning of marine ecosystems. The health of a marine food web strongly depends on the availability of nutrients at the primary producer level and particularly bio-available nitrogen. We investigated the influence of ocean acidification and warming on the quantity and quality of carbon and nitrogen, in the form of amino acid (AA), in particulate organic matter (POM) during a 22-day mesocosm experiment. We used coastal water plankton communities taken from Evans' Bay, Wellington, and applied two treatments and a control (each in duplicate). The controls mimicked the 2018 pH and temperature, and the two treatments simulated projected conditions adapted to NZ coastal waters in 2100 (+2.6 °C, – 0.33 pH) and 2150 (+4.5 °C, – 0.5 pH).

No significant effect of the various treatments on the AA POM concentrations was found. We then further investigated the origin and subsequent cycling of POM using AA-specific stable isotope analysis, and carbon and nitrogen elemental compositions. A combination of these biomarkers and subsequent statistical analyses indicated a clear species switch in the phytoplankton community composition in the various treatments from Day12 of the experiment. Application of the $\delta^{15}N_{AA}$-based proxy (ΣV) showed that heterotrophic bacterial recycling of POM was not affected by the treatments during the experiment.

Overall, these results suggest that the combined effect of ocean warming and ocean acidification will likely cause a species switch in the phytoplankton community; and while the food source might change, acidification and warming should however not affect the integrity, in terms of 'fresh' vs 'recycled', and quantity of AA available to the base of future marine ecosystems.