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Summer f-ratios and net community production in the Australian sector of Southern Ocean: contrasting regimes of nutrient availability and ecosystems functioning.

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During the SAZ-SENSE expedition (Jan.-Feb. 2008; R/V Aurora Australis) conducted in the Australian sector of the Southern Ocean, three process stations were selected on the basis of their hydrodynamic, physico-chemical and ecosystem characteristics to assess the role of variability in iron supply to ecosystem functioning. These sites were located in the Subantarctic Zone (SAZ) southwest and southeast of Tasmania, and in the Polar Front Zone (PFZ) further south. Our first goal was to investigate relationships between new production, estimated by ^{15}N, ^{13}C techniques and net community production estimated from in-situ, continuous O_2/Ar measurements. We compared f-ratios, defined as the ratios of nitrate-based production to total primary production, with the ratios of net to gross community production. Our results show that in most cases regenerated production was higher than new production, with sites differing in terms of euphotic layer depth, integrated production and short term (multi-days) temporal variability of production. The SAZ site south-west of Tasmania was characterized by a large variability in the primary production over the duration of station occupation (5 days), and f-ratios were also quite variable reaching the lowest and highest value observed for this study (C-uptake = 8.7 to 81.2 mmol.m^{-2}.d^{-1};

DIN-uptake = 2.3 to 12.3 mmol.m^{-2}.d^{-1}; f-ratio = 0.14 to 0.50; Net Community Productivity (NCP) = 13 to 136 mmolO_2.m^{-2}.d^{-1}). The PFZ site was characterized by the lowest and least variable productivity (C-uptake = 25.5 to 30.2 mmol.m^{-2}.d^{-1}; DIN-uptake = 4.6 to 8.8 mmol.m^{-2}.d^{-1}; f-ratio = 0.20 to 0.30; NCP = 24 to 34 mmolO_2.m^{-2}.d^{-1}). The SAZ south-east of Tasmania was characterized by a relatively high but quite stable productivity, and low f-ratios (C-uptake = 36.7 to 60.2 mmol.m^{-2}.d^{-1}; DIN-uptake = 7.1 to 20.0 mmol.m^{-2}.d^{-1}; f-ratio = 0.17 to 0.26; NCP = 77 to 140 mmolO_2.m^{-2}.d^{-1}).

Thus, net community production and f-ratios highlight large differences in nutrient availability and ecosystem functioning between these three regions. Whether these differences are directly controlled by differences in micro-nutrient supply remains to be assessed.