

Supplementary Material For: The Impact of Large-Scale Macroalgae Cultivation and Harvesting Strategies on the Marine Carbon Dioxide Removal Efficacy and Marine Biogeochemistry

Prima Anugerahanti^{1 *}, Julien Palmiéri², Chelsey A. Baker², Ekaterina Popova²,
and Andrew Yool²

¹*National Oceanography Centre, Joseph Proudman Building, 6 Brownlow Street,
Liverpool L3 5DA, UK*

²*National Oceanography Centre, European Way, Southampton SO14 3ZH, UK*

** Corresponding author: Prima Anugerahanti, (prianu@noc.ac.uk)*

October 29, 2025

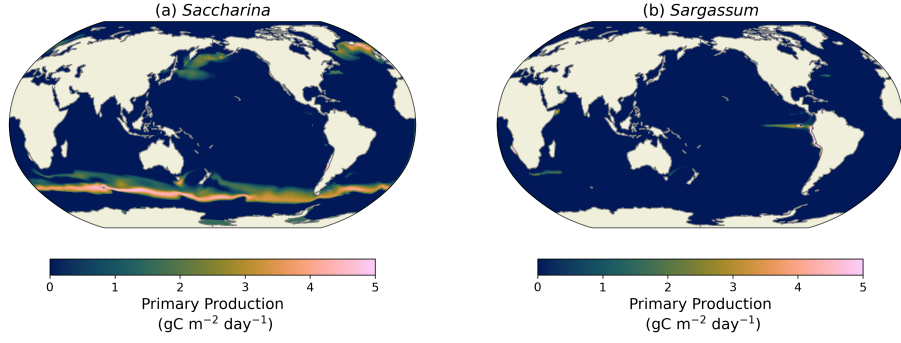


Figure S1: Macroalgae Net Primary Production (NPP) of (a) *Saccharina* and (b) *Sargassum* from the default experiment averaged between 2015-2024. Other species concentrations are not shown since these are in very small concentrations

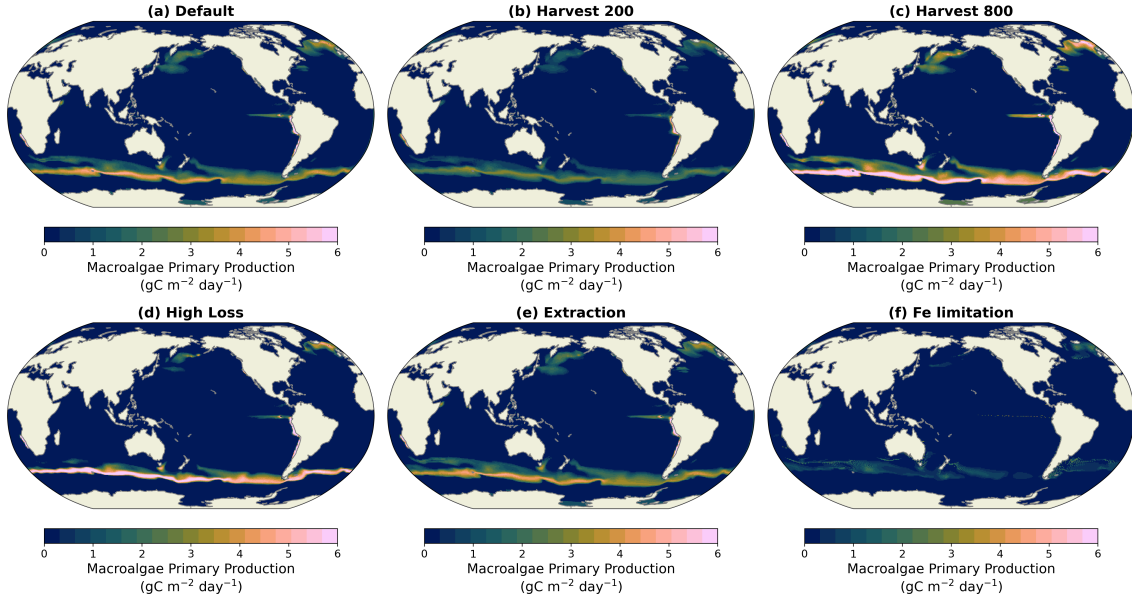


Figure S2: Macroalgae NPP of (a) default, (b) Harvest 200, (c) Harvest 800, (d) High Loss, (e) Extraction, and (f) Fe Limitation. These results are averaged between 2015-2024. Please refer to Table 2 in the main text for experiment name.

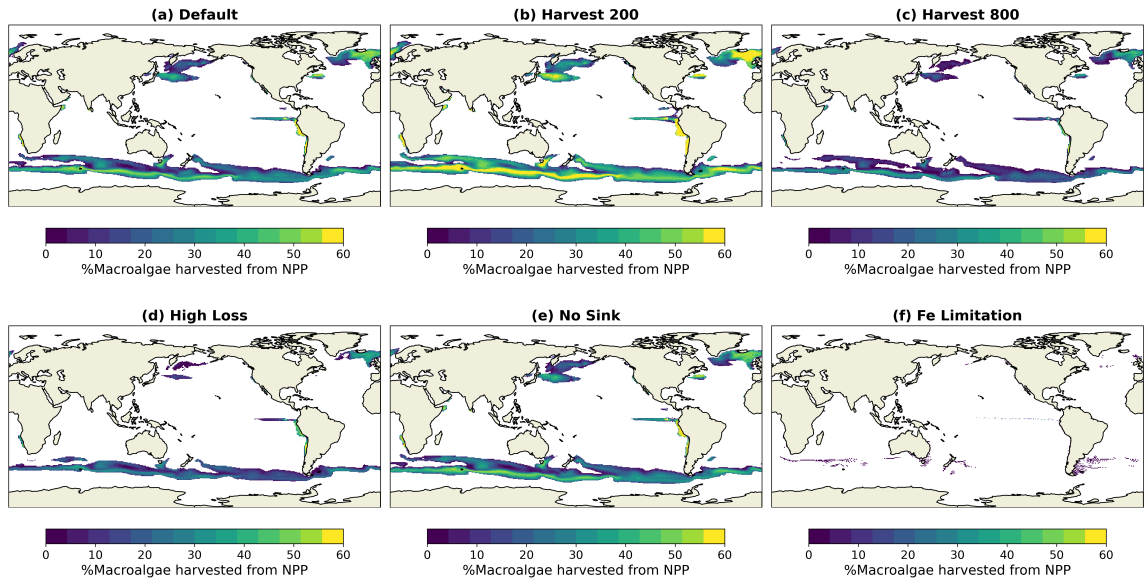


Figure S3: Proportion of harvest compared to macroalgae NPP from different experiments; (a) default, (b) Harvest 200, (c) Harvest 800, (d) High Loss, (e) Extraction, and (f) Fe Limitation.

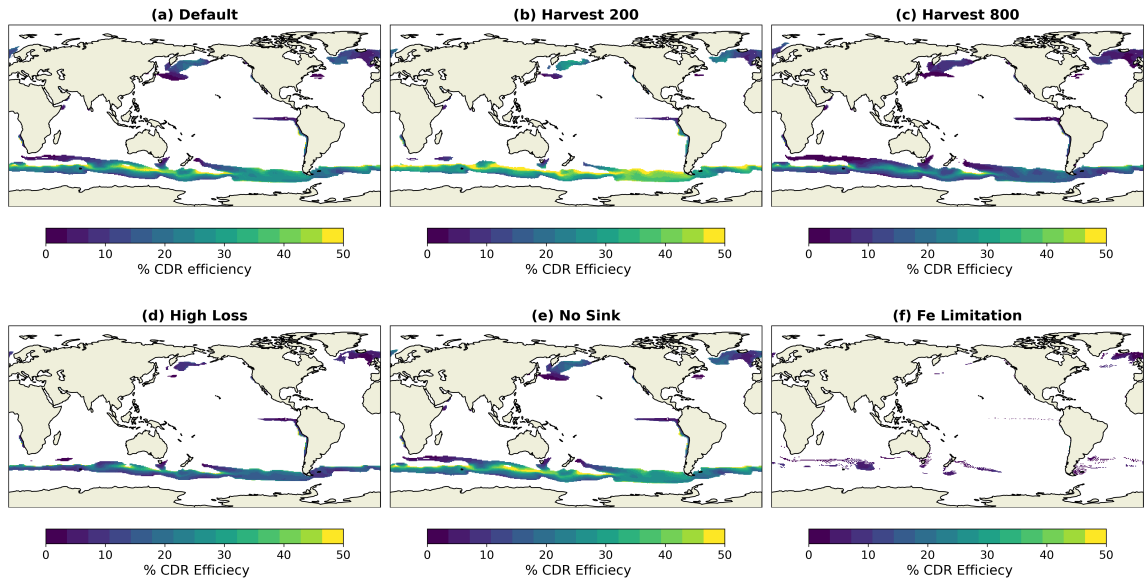


Figure S4: CDR_{eff} NPP from different experiments; (a) default, (b) Harvest 200, (c) Harvest 800, (d) High Loss, (e) Extraction, and (f) Fe Limitation. These are calculated from the fraction of additional CO_2 flux from macroalgae NPP

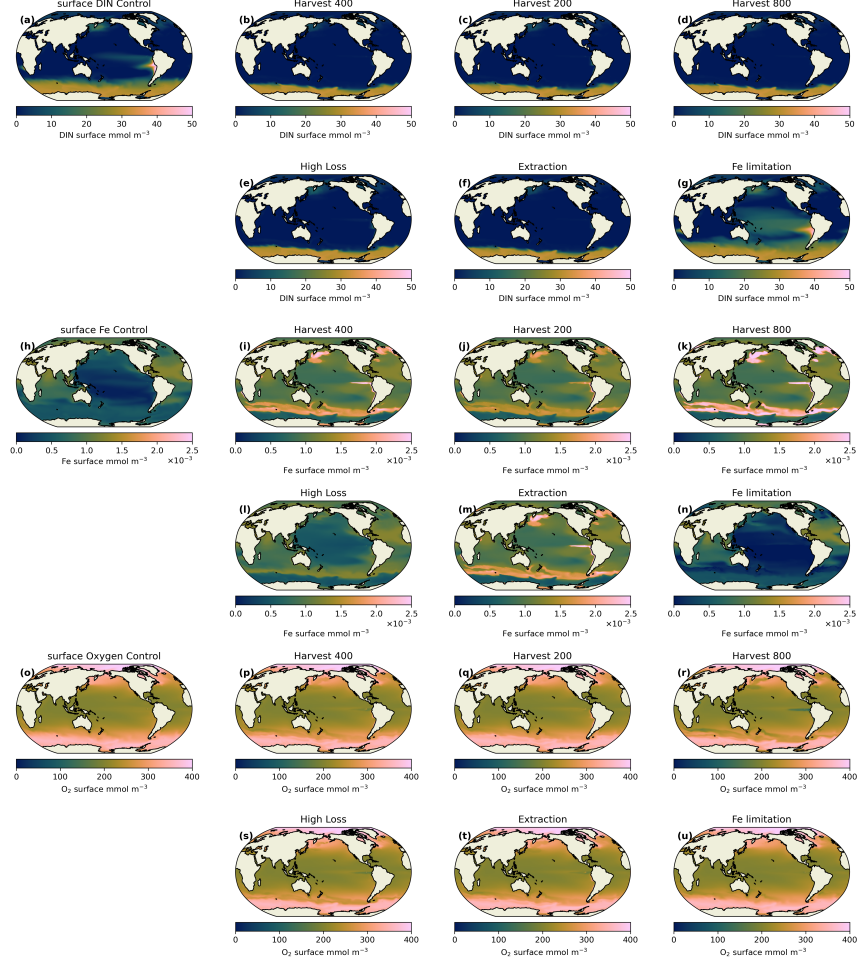


Figure S5: Surface nutrients and oxygen. Dissolved inorganic nitrogen (DIN) 2015-2024 averages from the control and other experiments are shown in a-g, iron (Fe) in h-n, and Oxygen in o-u. The first column (a,h,o) shows the control simulation. The odd number rows show the harvest experiment, while the even rows show high loss, extraction, and Fe limitation experiments.

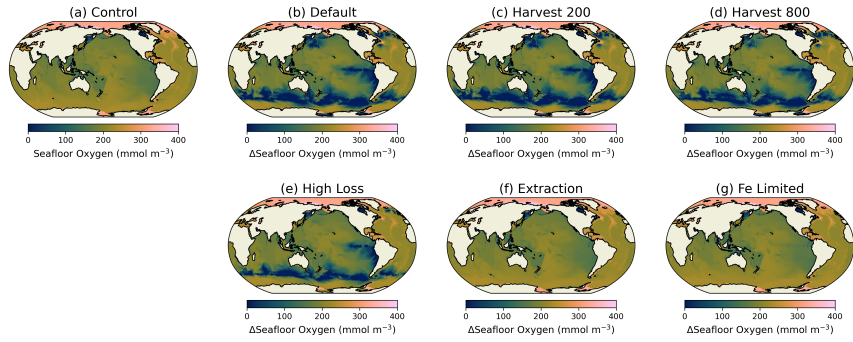


Figure S6: Seafloor oxygen concentration from the control simulation (a) and other macroalgae experiments. c and d show harvesting experiments and e,f,g show high non-harvesting loss, not sinking harvested macroalgae, and not supplementing iron, respectively.

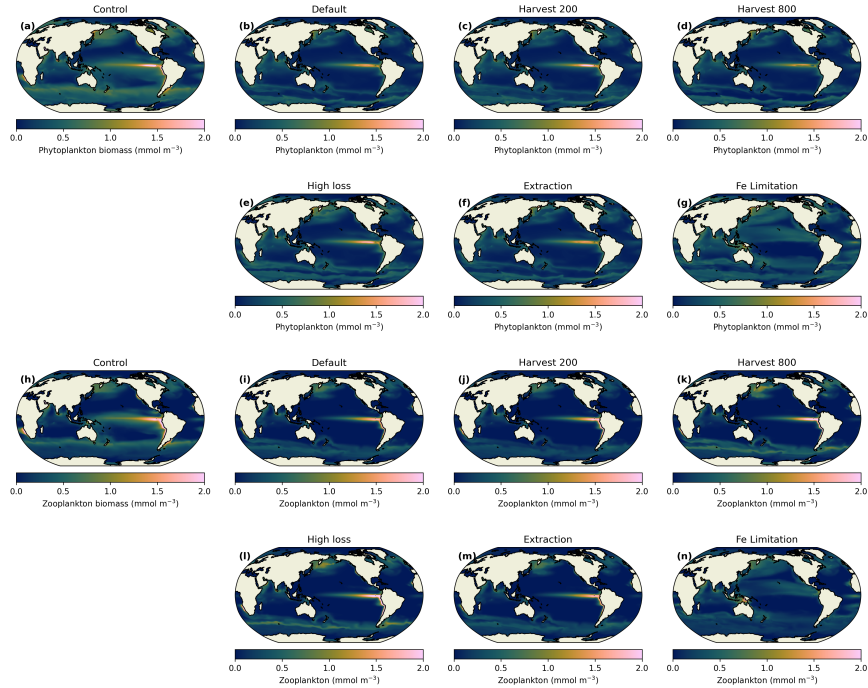


Figure S7: Phytoplankton (a-g) and zooplankton biomass (h-n) from control simulation and other macroalgae experiments. These are arranged similarly to Figures S5 and S6