

Supplementary Figures

Spatial patterns of nitrogen-transforming processes in the Southern Ocean: Potential role of Dissimilatory Nitrate Reduction (DNR)

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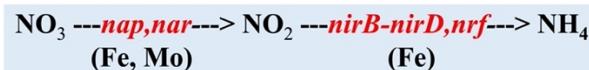
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³CNRS, Université Brest, IRD, Ifremer, Laboratoire des Sciences de l'environnement marin, Technopôle Brest-Iroise, Plouzané, France.

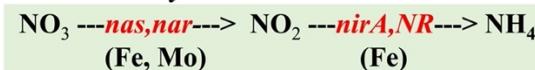
✿ Denitrification:



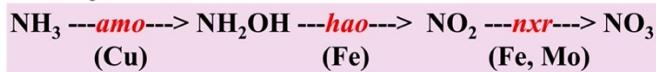
✿ Dissimilatory Nitrate Reduction to Ammonium (DNRA)



✿ Assimilatory Nitrate Reduction to Ammonium (ANR)



✿ Nitrification:



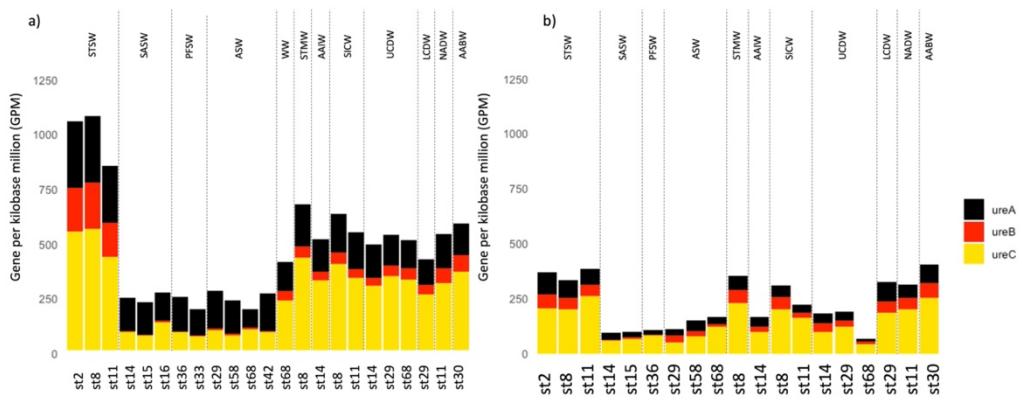
✿ Nitrogen fixation:



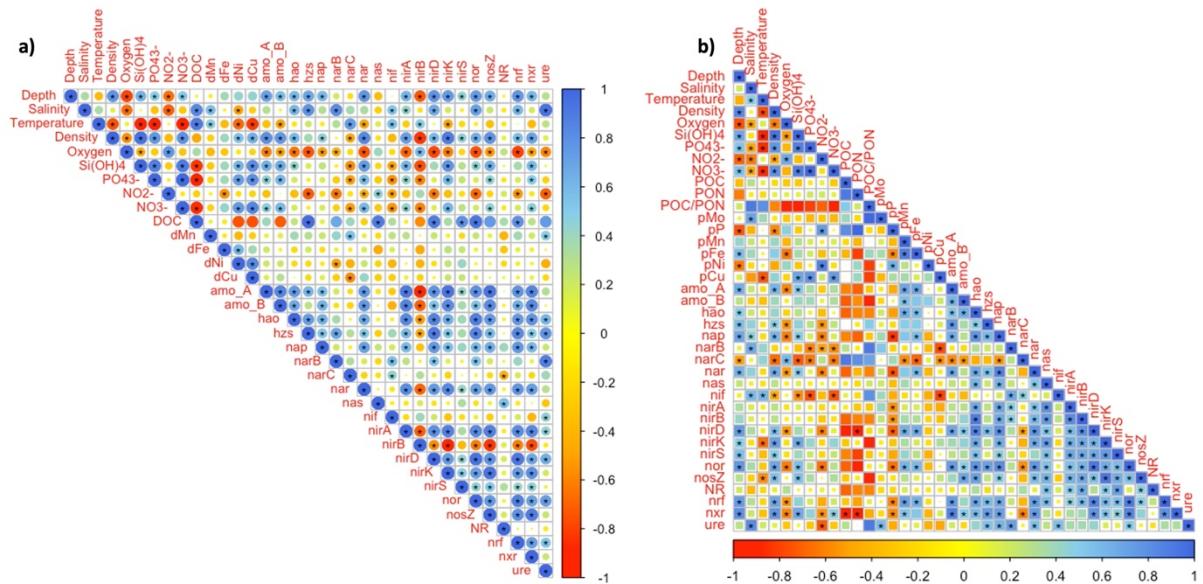
✿ Anaerobic Ammonium Oxidation (ANAMMOX):



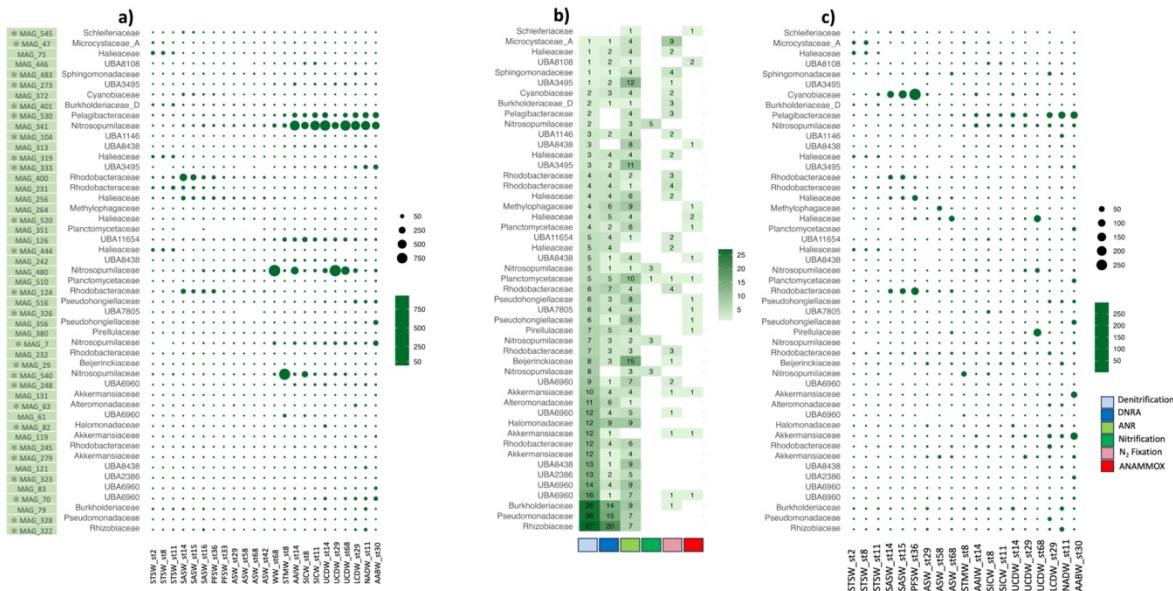
Supplementary Figure. 1 Reactions of N-transforming processes and the corresponding trace metals employed by the metalloenzymes.



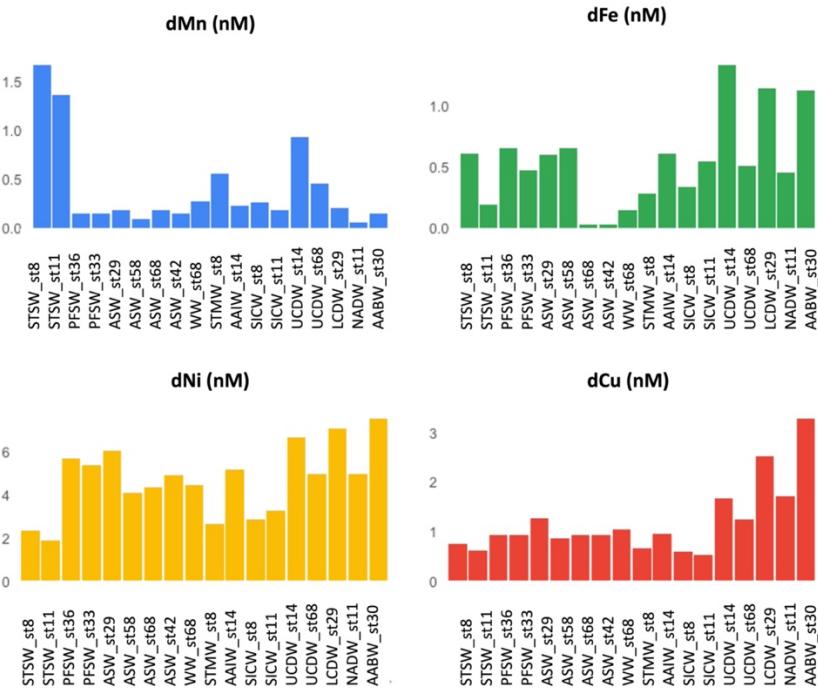
Supplementary Figure. 2 Relative abundances (GPMs) of urease genes in the **a)** free-living and **b)** particle-attached communities.



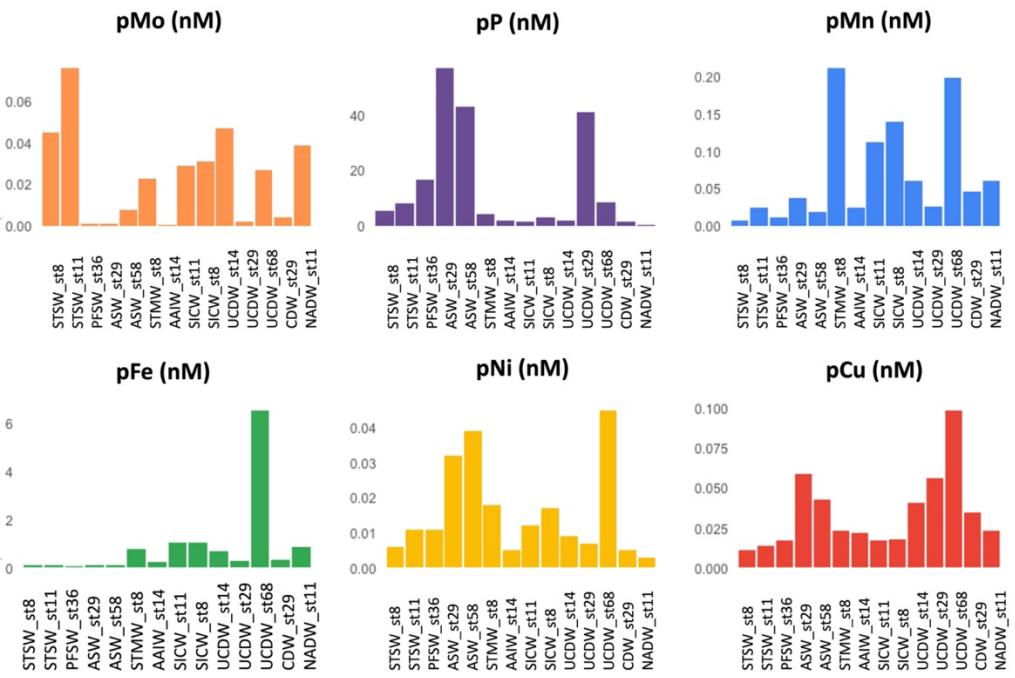
Supplementary Figure. 3 Results of the Spearman correlation analyses for the **a)** free-living and **b)** particle-attached communities. Stars indicate significant correlations ($p < 0.05$).



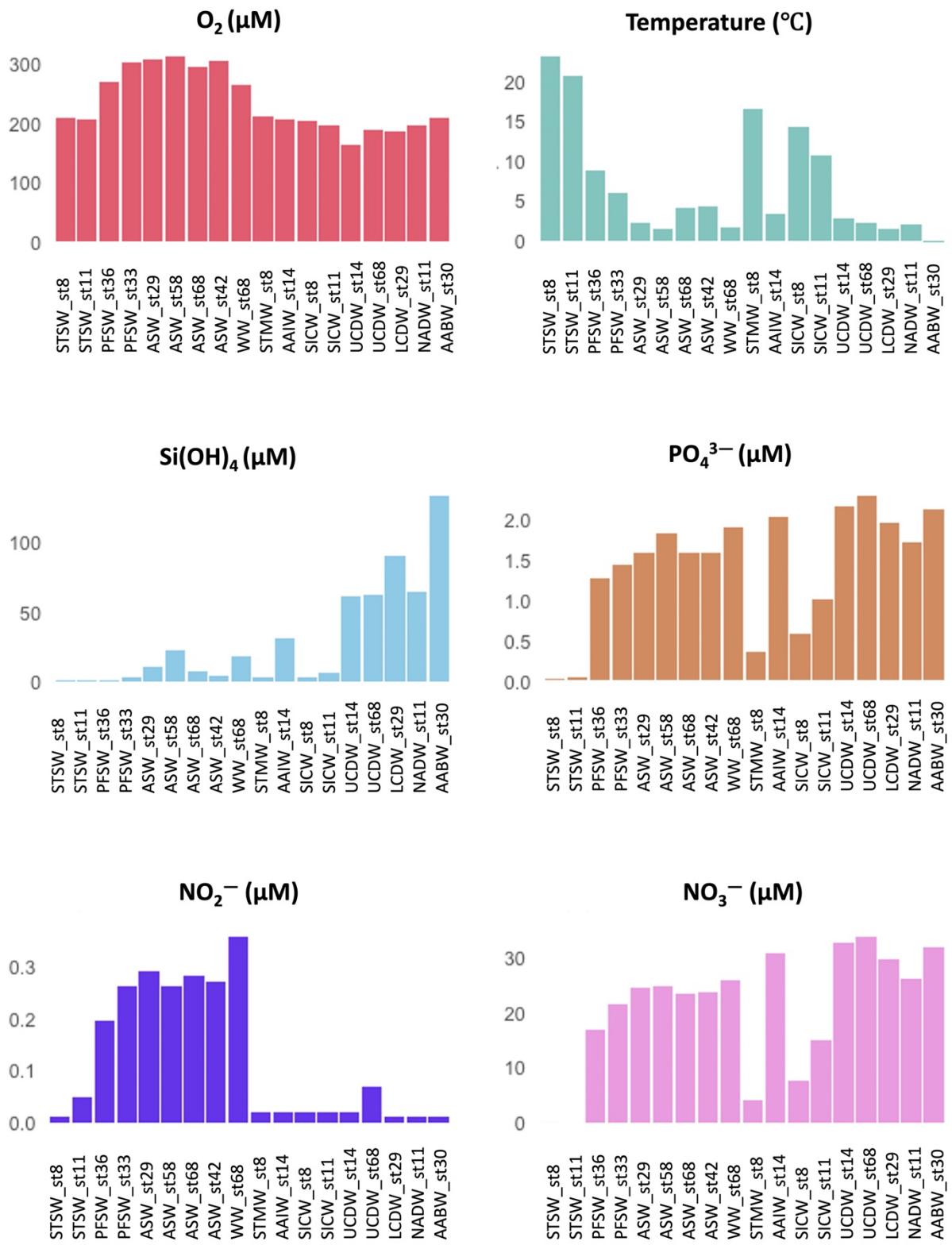
Supplementary Figure. 4 a) Coverage of representative MAGs in FL communities **b)** Copy numbers of representative N-transforming genes encoded by the MAGs. **c)** Coverage of representative MAGs in PA communities. Stars represent the MAGs with species affiliation.



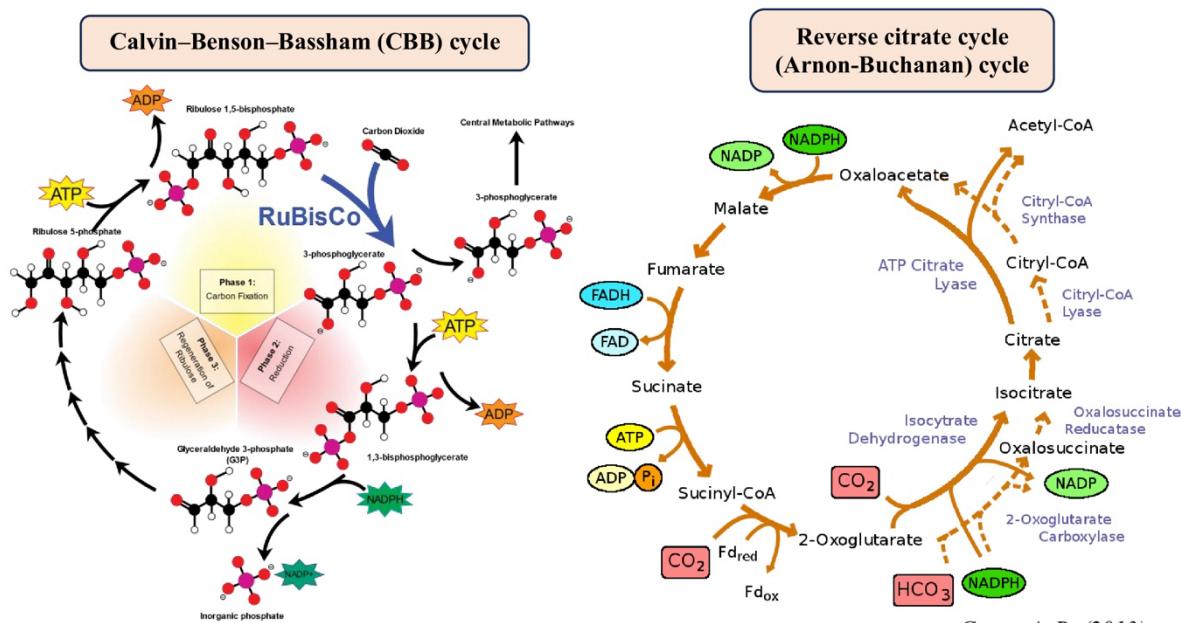
Supplementary Figure. 5 Dissolved TM concentrations at the depth of sample collection for metagenomic analyses.



Supplementary Figure. 6 Particulate TM concentrations at the depth of sample collection for metagenomic analyses.



Supplementary Figure. 7 Physiochemical parameters concentrations, of the samples collected for metagenomic analyses.



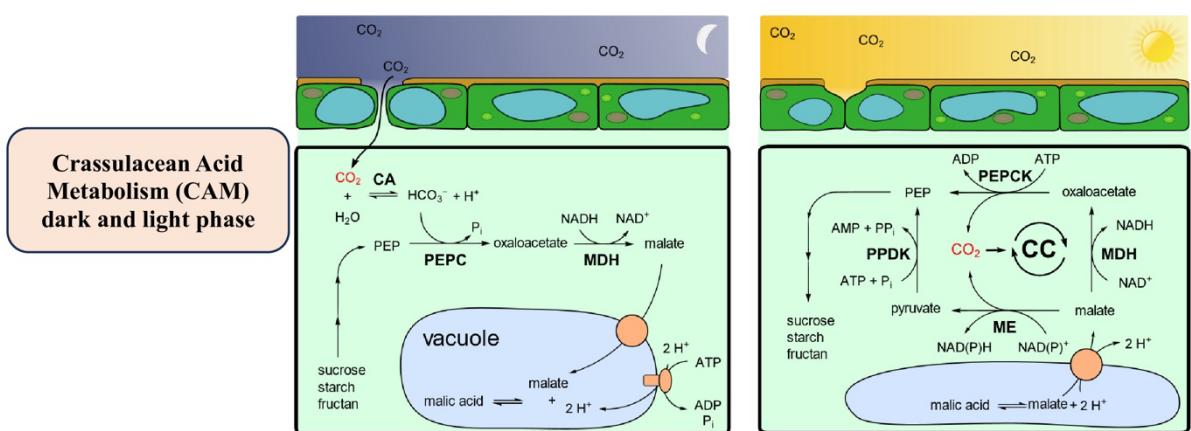
Gross, A. R. (2013).

A pathway diagram of the reductive TCA cycle. CC BY-SA 3.0.

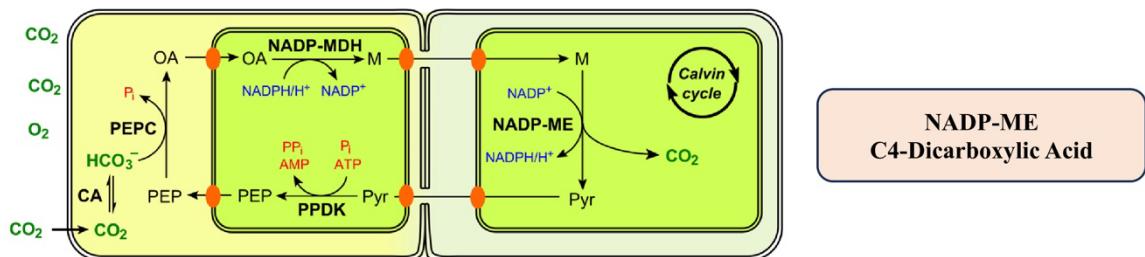
Wikimedia Commons.

Mike Jones et al., 2010.

Overview of the Calvin cycle and carbon fixation. CC BY-SA 3.0.



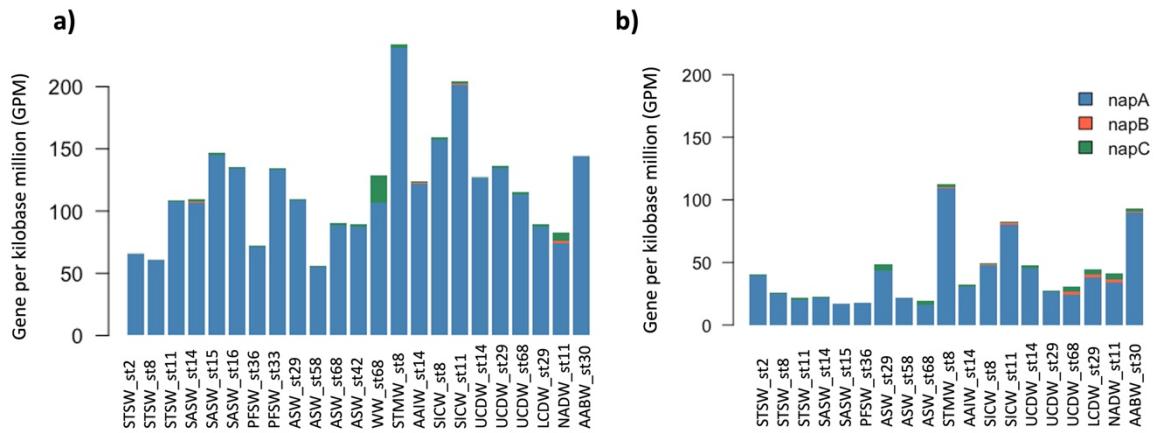
Ed (Edgar181 et al., 2016), based on Yikrazuul. Overview of CAM cycle. Public Domain.



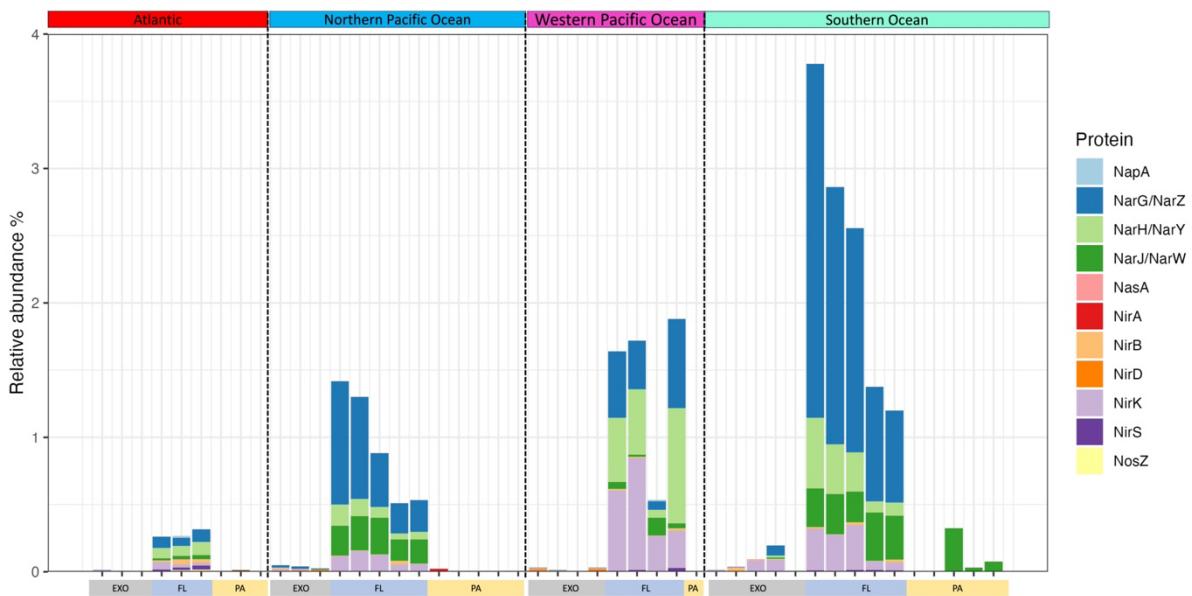
Yikrazuul et al., 2011. Overview of C4 photosynthesis NADP-ME type. CC BY-SA 3.0.

NADP-ME - Nicotinamide adenine dinucleotide phosphate - Malic enzyme, **CA** - Carbonic anhydrase, **HCO_3^-** - Bicarbonate, **PEP** - phosphoenolpyruvate, **Pi** - phosphate, **PEPC** - PEP carboxylase, **OA** - oxaloacetate, **M** - malate, **Pyr** - pyruvate, **PPDK** - Pyruvate phosphate dikinase, **PPi** - pyrophosphate, **PGA** - phosphoglycerate, **FAD** - Flavin adenine dinucleotide, **CC** - Calvin Cycle

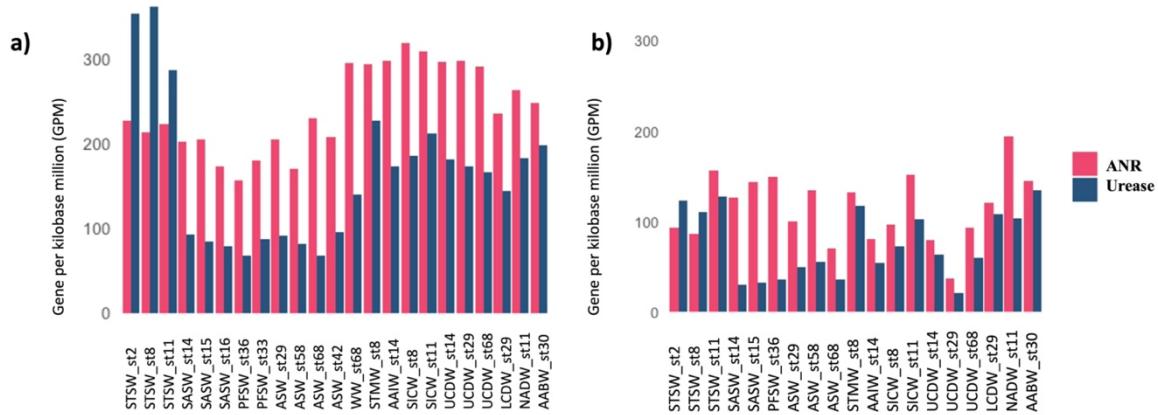
Supplementary Figure. 8 Inorganic carbon fixing pathways observed/detected in MAGs associated with N-transformations.



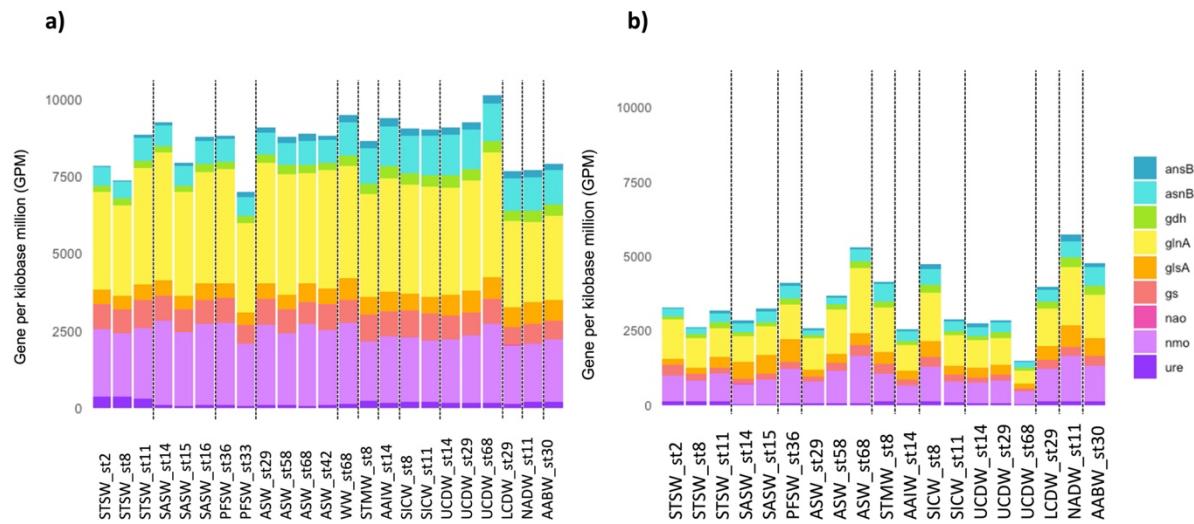
Supplementary Figure. 9 *nap* gene abundances in the a) free-living and b) particle-attached fractions.



Supplementary Figure. 10 Metaproteome representing DNR proteins expressed in free-living, particle-attached and exoproteomes of varying oceans. Data from Zhao et al. 2024.



Supplementary Figure. 11 Urease VS ANR gene abundances **a)** free-living and **b)** particle-attached fractions.



Supplementary Figure. 12 Organic N compounds synthesis and degradation gene abundances **a)** free-living and **b)** particle-attached fractions.