

Parameter	Value	Unit	Explanations
$[O_2]_E$	0.213	mol O ₂ m ⁻³	Saturated concentration at 25 °C and salinity of 34 (1).
$Y_{Nfix}^{C:N}$	1	mol mol ⁻¹	(2)(3).
$Y_{Bio}^{N:C}$	0.159	mol mol ⁻¹	(4).
I	400	μmol m ⁻² s ⁻¹	Boundary condition.
$Y^{Res:Bio}$	0.4	mol mol ⁻¹	Based on energetic balance (5)(2) with energy transfer efficiency of 0.6 (5) With biomass stoichiometry of C ₅ H ₇ O ₂ N _{0.8} .
$Y^{Res:Nfix}$	1.04	mol mol ⁻¹	
Q_C	18333	mol m ⁻³	(6).

The parameters are listed roughly in order of appearance in Methods and Supplementary Methods.

References

1. **Benson BB, Krause D.** 1984. The concentration and isotopic fractionation of oxygen dissolved in freshwater and seawater in equilibrium with the atmosphere. *Limnol Oceanogr* **29**:620–632.
2. **Inomura K, Bragg J, Follows MJ.** 2017. A quantitative analysis of the direct and indirect costs of nitrogen fixation: a model based on *Azotobacter vinelandii*. *ISME J* **11**:166–175.
3. **Inomura K, Bragg J, Riemann L, Follows MJ.** 2018. A quantitative model of nitrogen fixation in the presence of ammonium. *PLOS ONE* **13**:e0208282. <https://doi.org/10.1371/journal>.
4. **LaRoche J, Breitbarth E.** 2005. Importance of the diazotrophs as a source of new nitrogen in the ocean. *J Sea Res* **53**:67–91.
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