

**Table S3. Parameters for the ocean biogeochemical model.**

Symbol	Description	Unit	Default value	Reference
$a_1$	Assimilated fraction of grazing by Z1	-	0.7	Lavoie et al. (2009)
$a_2$	Assimilated fraction of grazing by Z2	-	0.7	Lavoie et al. (2009)
$\alpha^{p1} / P_m^{p1}$	Ratio of photosynthetic parameters (photosynthetic efficiency and maximum photosynthetic rate) for P1	$(\mu\text{mol photons m}^{-2} \text{ s}^{-1})^{-1}$	0.07	This study
$\alpha^{p2} / P_m^{p2}$	Ratio of photosynthetic parameters (photosynthetic efficiency and maximum photosynthetic rate) for P2	$(\mu\text{mol photons m}^{-2} \text{ s}^{-1})^{-1}$	0.07	This study
$b_{nit}$	Temperature sensitivity coefficient for nitrification	$(^\circ\text{C})^{-1}$	0.0693	Kawamiya et al. (1995)
$f_{d1}$	Grazing preference on D1	-	0.5	Monahan and Denman (2004)
$f_{d2}$	Grazing preference on D2	-	0.5	Lavoie et al. (2009)
$f_{z1}$	Grazing preference on Z1	-	0.5	Monahan and Denman (2004)
$\gamma_{z1}$	Specific grazing rate of Z1	$\text{d}^{-1}$	1	This study
$\gamma_{z2}$	Specific grazing rate of Z2	$\text{d}^{-1}$	1	This study

$k_{z1}$	Half-saturation constant for Z1 grazing	mmol N m <sup>-3</sup>	1	This study
$k_{z2}$	Half-saturation constant for Z2 grazing	mmol N m <sup>-3</sup>	1	This study
$m_{lp1}$	Rate constant for P1 linear mortality	d <sup>-1</sup>	0.03	This study
$m_{lp2}$	Rate constant for P2 linear mortality	d <sup>-1</sup>	0.03	This study
$m_{lz1}$	Rate constant for Z1 linear mortality	d <sup>-1</sup>	0.03	This study
$m_{lz2}$	Rate constant for Z2 linear mortality	d <sup>-1</sup>	0.03	This study
$m_{qp2}$	Rate constant for P2 quadratic mortality	d <sup>-1</sup> (mmol N m <sup>-3</sup> d <sup>-1</sup> ) <sup>-1</sup>	0.05	This study
$m_{qz2}$	Rate constant for Z2 quadratic mortality	d <sup>-1</sup> (mmol N m <sup>-3</sup> d <sup>-1</sup> ) <sup>-1</sup>	0.1	This study
$\mu_{m1}^{max}$	Maximum specific growth rate of P1	d <sup>-1</sup>	0.5	Steiner et al. (2006)
$\mu_{m2}^{max}$	Maximum specific growth rate of P2	d <sup>-1</sup>	2.0	Steiner et al. (2006)
$Q_{10p}$	Q10 factor for phytoplankton	-	1.55	Suzuki and Takahashi (1995)
$Q_{10z}$	Q10 factor for zooplankton	-	2.14	Buitenhuis et al. (2006)
$Q_{10b}$	Q10 factor for bacteria	-	1.9	Aumont et al. (2015)
$r_{d1}$	Rate constant for	d <sup>-1</sup>	0.03	Steiner et al.

	D1 remineralization			(2006)
$r_{d2}$	Rate for D2 remineralization	$d^{-1}$	0.3	Lavoie et al. (2009)
$r_{bsi}$	Rate constant for BSi remineralization	$d^{-1}$	0.01	This study
$r_{n0}$	Nitrification rate at 0 °C in seawater	$d^{-1}$	0.03	Kawamiya et al. (1995)
$w_{d1}$	D1 sinking rate	$m d^{-1}$	1	This study
$w_{d2}$	D2 sinking rate	$m d^{-1}$	50	Lavoie et al. (2009)

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