

1 The effect of nutrients on carbon and nitrogen fixation by the UCYN-A-haptophyte  
2 symbiosis  
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21 Dust / single-cell

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23 *Running title:* Nutrient effects on UCYN-A-haptophyte symbiosis

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26 *Subject category:* Microbe-microbe and microbe-host interactions

1 Supplementary Fig. 1: Summary of AT%  $^{13}\text{C}$  and  $^{15}\text{N}$  isotopic signal for (A,C)  
2 UCYN-A and (B,D) haptophyte cells correlating to the respective cell diameters  
3 across nutrient treatments as described in the Material and Methods.

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5 Supplementary Fig. 2: Summary of nanoSIMS measurements showing the  $^{13}\text{C}$  and  
6  $^{15}\text{N}$  isotopic signal in AT% for association between (A) UCYN-A and (B) haptophyte  
7 according to different nutrient treatments as described in the Material and Methods.

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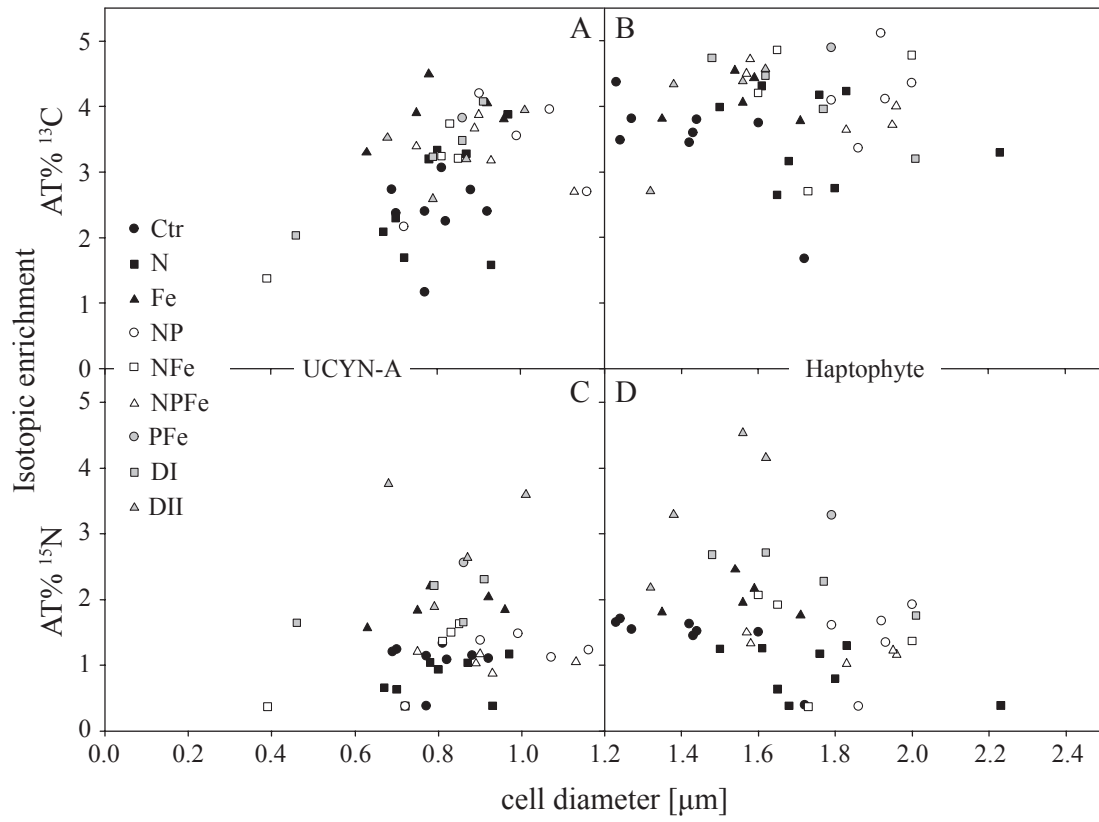
9 Supplementary Fig. 3: Summary of nanoSIMS measurements showing the  $^{13}\text{C}$  and  
10  $^{15}\text{N}$  isotopic signal (AT%) within individual UCYN-A cells and their corresponding  
11 partner cell (haptophyte) according to various nutrient treatments as described in the  
12 Material and Methods. Circles (open and filled) represent UCYN-A cells and squares  
13 (open and filled) represent haptophyte cells. The color-coding refers to the respective  
14 partner cells.

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16 Supplementary Table 1: Summary of nanoSIMS analysis for the UCYN-A-  
17 haptophyte association from nutrient incubation experiments conducted on surface  
18 seawater samples collected from Cape Verde May 2009. The range, mean and  
19 standard deviation (SD) are listed for  $^{13}\text{C}$  atom % and  $^{15}\text{N}$  atom % (AT %) measured  
20 in individual cells. Corresponding  $\text{CO}_2$  and  $\text{N}_2$  fixation rates and C and N transfer  
21 rates for individual UCYN-A and partner haptophyte cells are calculated based on the  
22 nanoSIMS and cell dimension analysis.

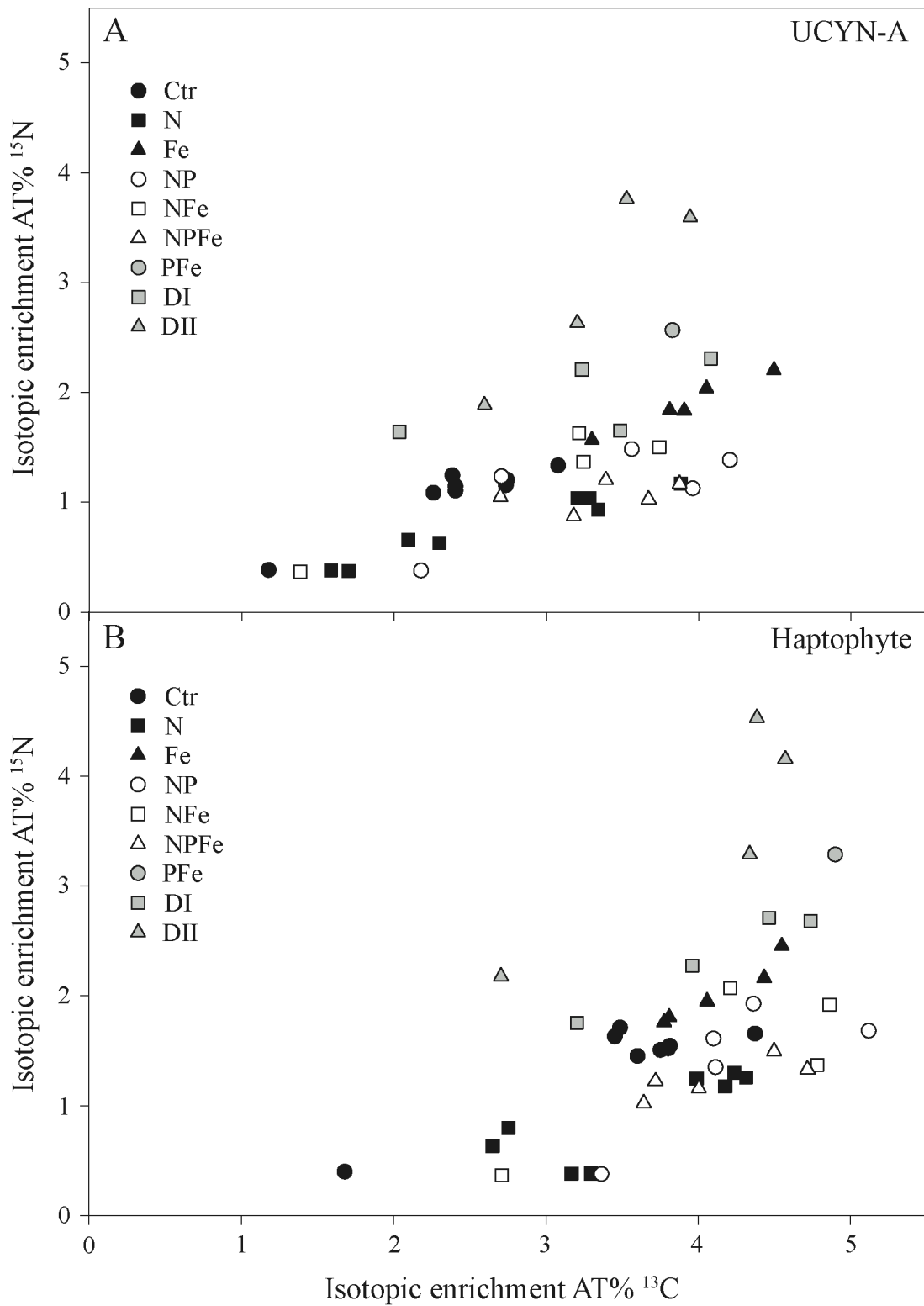
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1 Supplementary Fig. 1



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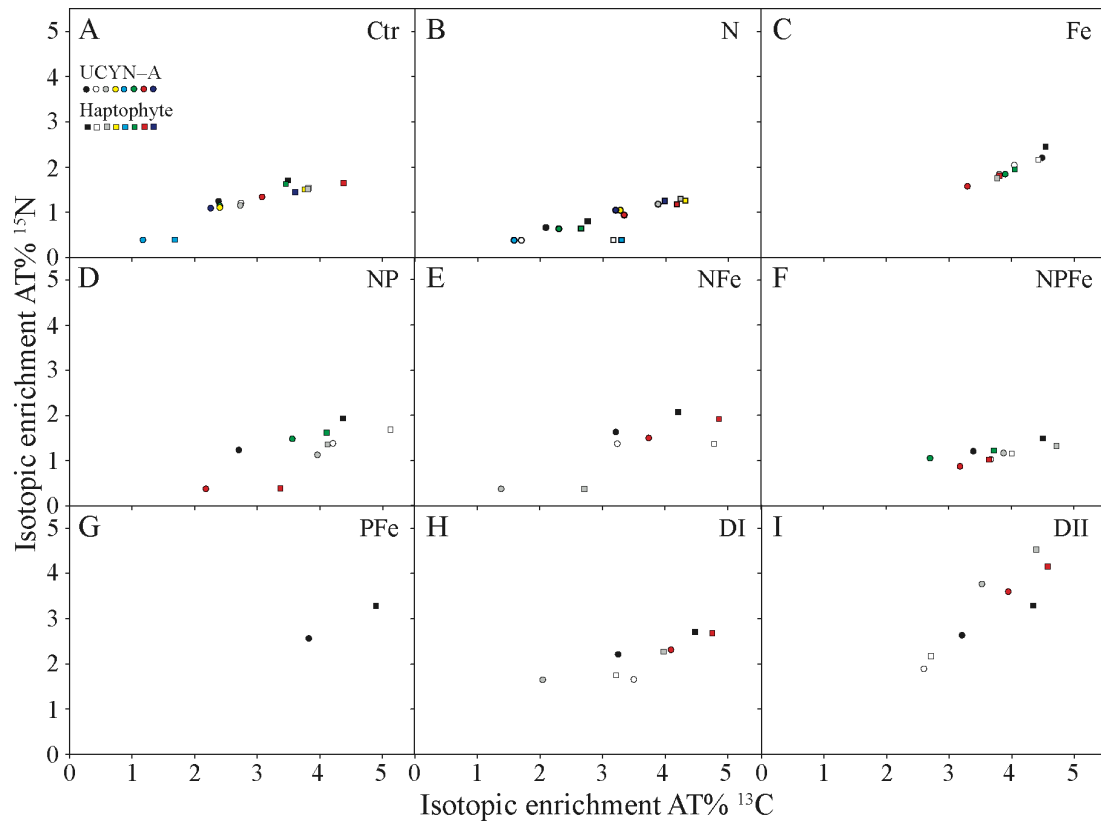
1 Supplementary Fig. 2



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Supplementary Fig. 3



Supplementary Table 1

Experiment	n <sup>a</sup>	AT% <sup>13</sup> C		CO <sub>2</sub> fixation or C transfer rate (fmol C cell <sup>-1</sup> h <sup>-1</sup> )		AT% <sup>15</sup> N		N <sub>2</sub> fixation or N transfer rate (fmol N cell <sup>-1</sup> h <sup>-1</sup> )	
		range (mean±SD)		range		range (mean±SD)		range	
		UCYN-A	Haptophyte	UCYN-A	Haptophyte	UCYN-A	Haptophyte	UCYN-A	Haptophyte
Ctr	8	1.18–3.08	1.68–4.37	0.0038–0.1016	0.1254–0.4796*	0.38–1.34	0.40–1.71	0.0001–0.0046	0.0008–0.0239
		(2.40±0.20)	(3.49±0.28)			(1.08±0.10)	(1.43±0.15)		
N	8	1.58–3.88	2.75–4.31	0.0225–0.2220	0.3011–0.8454*	0.38–1.17	0.38–1.30	0.0000–0.0057	0.0004–0.0266
		(2.67±0.30)	(3.57±0.24)			(0.78±0.11)	(0.90±0.14)*		
Fe	5	3.30–4.49	3.78–4.55	0.0575–0.2106*	0.3330–0.5937*	1.57–2.20	1.76–2.46	0.0028–0.0104*	0.0205–0.0401*
		(3.91±0.19)*	(4.12±0.16)			(1.90±0.11)*	(2.03±0.13)*		
NP	5	2.18–4.20	3.36–5.12	0.0398–0.2938*	0.5760–1.0974*	0.38–1.49	0.38–1.93	0.0000–0.0084	0.0004–0.0544
		(3.32±0.38)*	(4.21±0.28)			(1.12±0.20)	(1.39±0.27)		
NFe	4	1.38–3.74	2.71–4.86	0.0022–0.1407	0.3480–1.1036*	0.37–1.63	0.37–2.07	0.0000–0.0064	0.0001–0.0357
		(2.89±0.52)	(4.14±0.50)			(1.22±0.29)	(1.43±0.38)		
NPFe	5	2.70–3.87	3.64–4.72	0.0940–0.1900*	0.5878–0.8321*	0.88–1.21	1.03–1.50	0.0031–0.0047	0.0187–0.0282
		(3.36±0.20)*	(4.12±0.21)			(1.07±0.06)	(1.25±0.08)*		
Pfe	1	3.83 (na**)	4.90 (na**)	0.1594	0.8850	2.57 (na**)	3.29 (na**)	0.0115	0.0789
		2.03–4.08	3.20–4.74			1.64–2.31	1.76–2.71		
DI	4	(3.21±0.43)	(4.09±0.34)	0.0108–0.2012	0.5496–0.6490*	(1.96±0.18)*	(2.36±0.22)*	0.0013–0.0117*	0.0406–0.0505*
		2.59–3.94	2.70–4.57			1.89–3.76	2.18–4.53		
DII	4	(3.32±0.28)*	(4.00±0.43)	0.0703–0.2520	0.1879–0.6447	(2.97–0.44)*	(3.54±0.52)*	0.0063–0.0255*	0.0245–0.0823*

\*significantly different from control measurements

\*\*not applicable

<sup>a</sup> Number of cells measured in each treatment