Figure S1a-d. Representative standard curves for qPCR and results from specificity experiments. (a) The standard curve for UCYN-A1 host primers and probes and the cross reactivity when the UCYN-A1 host primers and probes were run with UCYN-A2 host standards as template. (b) The standard curve obtained for het-1 and the cross-reactivity with het-2 assay run in standard and fast modes. (c) The standard curve obtained for UCYN-A1 and the cross-reactivity with UCYN-A2 when the assay is run in fast mode at 60º C and 64º. (d) The standard curve obtained for UCYN-A2 and the cross-reactivity with UCYN-A1 when assay is run in fast mode at 60º C and 64º.

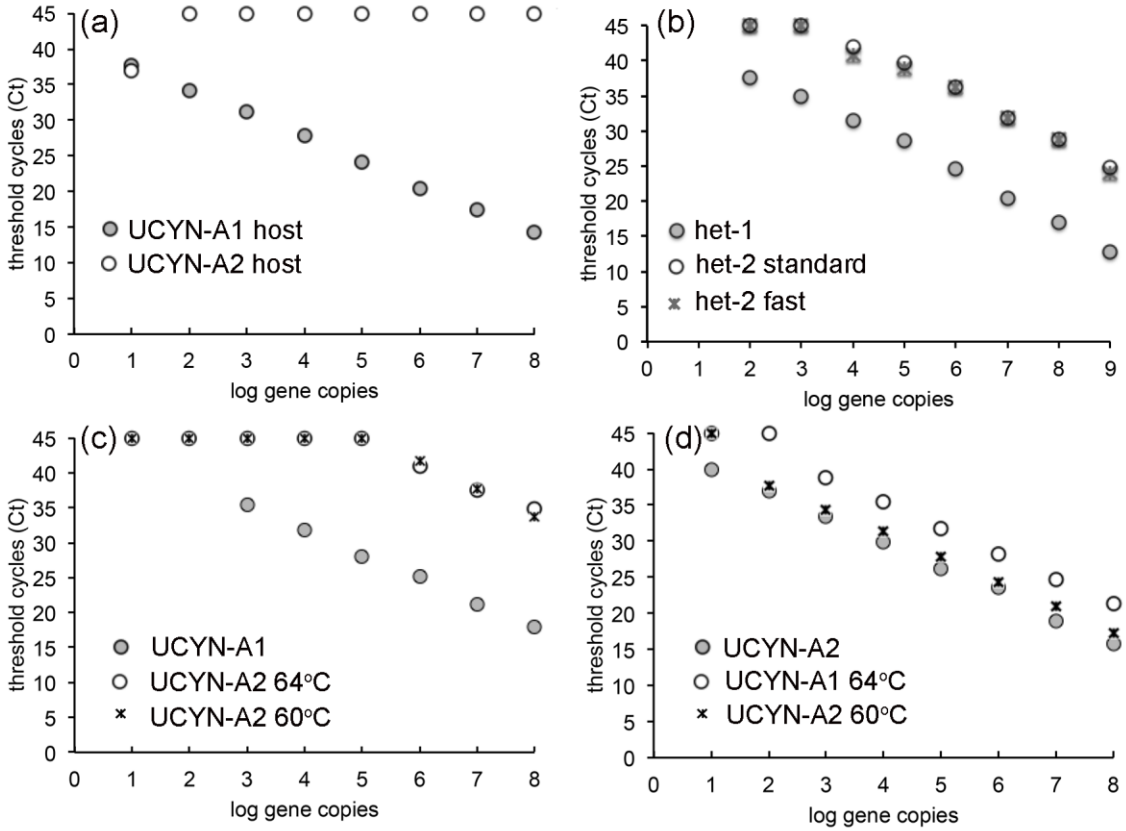

Table S1. Previously and newly designed oligonucleotides used in this study.

Phylotype	**Forward Primer 5' to 3'**	**Probe 5' to 3'**	**Reverse Primer 5' to 3´**	**Reference**
UCYN-A1	AGCTATAACAACGTTTTATGCGTGA	TCTGGTGGTCCTGAGCCTGGA	ACCACGACCAGCACATCCA	Church et al. 2005
UCYN-A2	GGTTACAACAACGTTTTATGTGTTGA	TCTGGTGGTCCTGAGCCCGGA	ACCACGACCAGCACATCCA	Thompson et al. 2014
UCYN-B	CGTAATGCTCGAAGGGTTTGA	TGTGCTGGTCGTGGTAT	CACGACCAGCACAACCAACT	Moisander et al. 2010
het-1	CGGTTTCCGTGGTGTACGTT	TCCGGTGGTCCTGAGCCTGGTGT	AATACCACGACCCGCACAAC	Church et al. 2005
het-2	TGGTTACCGTGATGTACGTT	TCTGGTGGTCCTGAGCCTGGTGT	AATGCCGCGACCAGCACAAC	Foster et al. 2007
het-3	CGGTTTCCGTGGCGTACGTT	TCTGGTGGTCCAGAACCTGGTGT	GAGCGGGTGTCGGAGACGGAT	Foster et al. 2007
Trichodesmium	GACGAAGTATTGAAGCCAGGTTTC	CATTAAGTGTGTTGAATCTGGTGGTCCTGAGC	CGGCCAGCGCAACCTA	Church et al. 2005
UCYN-A1 Host	AGGTTTGCCGGTCTGCCGAT	CTGGTAGAACTGTCCT	GAGCGGGTGTCGGAGACGGAT	This study
UCYN-A2 Host	GGTTTTGCCGGTCTGCCGTT	CTGGTGCGAGCGTCCTTCCT	GAGTGGGTGTCGGAGACGGAT	Thompson et al. 2014

Table S2. Summary of the comparison between the nifH gene copies (L-1) quantified in the 'at sea' vs. the lab based qPCR assays. The values from samples, which were at least one order of magnitude greater/lesser, are shown. The corresponding stations, depths (m) and percent of surface irradiance are provided.

Target	**Station ID**	**Depth (m) % light**	**'at sea' quantified *nifH* copies L^{-1}**	**lab quantified *nifH* copies L^{-1}**
UCYN-A1	SD3	10% (35)	18	bd
	SD4	54% (10)	18	bd
		10% (35)	7.28×10^5	8.82×10^3
	SD8	10% (45)	5.76×10^4	1.38×10^5
	SD9	36% (21)	23	3.29×10^2
		10% (45)	5.12×10^2	7.62×10^2
	LD B	75% (5)	17	bd
		36% (12)	12	bd
		10% (27)	1.08×10^3	bd
	LD C	54% (16)	18	bd
		10% (60)	4.68×10^3	3.20×10^5
UCYN-A2	SD1	10% (35)	56	1.32×10^2
	SD2	10% (36)	30	1.16×10^2
	SD4	10% (35)	1.40x104	3.41×10^3
	SD7	54% (12)	3.78×10^1	bd
		36% (21)	1.06×10^2	bd
	SD8	10% (45)	2.62×10^2	1.52×10^3
	SD9	54% (12)	43,9	bd
	LD B	75% (5)	63	bd

		10% (27)	1.07×10^3	bd
	LD C	54% (16)	3.24×10^2	bd
		10% (60)	3.25×10^5	8.54×10^4
UCYN-B	SD1	75% (5)	bd	4.09×10^5
		54% (9)	bd	1.65×10^5
	SD2	36% (15)	6.73×10^5	6.85×10^4
	SD3	54% (9)	7.41×10^3	2.72×10^4
		36% (16)	4.54×10^4	1.35×10^3
	SD7	10% (45)	1.81×10^5	7.25×10^4
	SD8	54% (12)	1.05×10^4	4.27×10^3
		36% (21)	2.90×10^4	9.11×10^3
		10% (45)	1.01×10^6	1.77×10^5
	LD B	75% (5)	1.78×10^4	2.55×10^2
		36% (12)	1.20×10^4	1.35×10^3
		10% (27)	9.60×10^2	1.78×10^3
	SD13	75% (5)	1.01×10^4	9.10×10^3
	LD C	75% (6)	4.68×10^2	3.64×10^3
	SD15	54% (16)	2.60×10^2	bd
		10% (58)	3.23×10^2	bd

Table S3. Summary of abundances determined by qPCR. Diazotroph targets are reported as the nifH copies L-1 and UCYN-A hosts are 18S rRNA copies L-1. Results for UCYN-C is limited to the 'at sea' qPCR and other targets are from lab-based analyses on archived samples. Samples which were not run on a particular target are designated with a dash (-). The following abbreviations apply: dnq, detected but not quantifiable and bd, below detection are explained in the methods.

Station	**CTD no**	**Latitude**	**Longitude**	**Date (yyyy-mm-dd)**	**Depth [m]**	**Trichodesmium [gene copies/l]**	**UCYN-A1 [gene copies/l]**	**UCYN-A2 [gene copies/l]**	**UCYN-B [gene copies/l]**	**UCYN-C [gene copies/l]**	**UCYNA1_Host [gene copies/l]**	**UCYNA2_Host [gene copies/l]**	**Het-1 [gene copies/l]**	**Het-2 [gene copies/l]**	**Het-3 [gene copies/l]**
SD1	5	-17,996	159,902	2015-02-22	0										
SD1	5	-17,996	159,902	2015-02-22	5	474850 3	bd	bd	409333	dnq	bd	bd	59893	1851	5879
SD1	5	-17,996	159,902	2015-02-22	9	164439 6	dnq	bd	165465	bd	bd	bd	40501	165	4257
SD1	5	-17,996	159,902	2015-02-22	16	210523 0	dnq	dnq	444917	bd	bd	bd	57622	833	3366
SD1	5	-17,996	159,902	2015-02-22	35	664309	796	132	889003	dnq	bd	bd	66297	2502	3324
SD1	5	-17,996	159,902	2015-02-22	70	1533	24839	2463	2150		11521	bd	bd	bd	dnq
SD1	5	-17,996	159,902	2015-02-22	105		bd	bd	534		bd	bd	bd	bd	bd
SD2	9	-18,618	162,119	2015-02-23	0										
SD2	9	-18,618	162,119	2015-02-23	5	321170	bd	bd	225392	499	bd	bd	2694	704	181
SD2	9	-18,618	162,119	2015-02-23	9	762749	bd	bd	139827	dnq	bd	bd	2219	1334	159

SD2	9	-18,618	162,119	2015-02-23	15		bd	bd	68535	56	bd	bd	109844	1351	83
SD2	9	-18,618	162,119	2015-02-23	36	dnq	86	116	143676	227	bd	bd	173847	1268	126
SD2	9	-18,618	162,119	2015-02-23	70	13759	3849	1124	1621		bd	dnq	6711	bd	dnq
SD2	9	-18,618	162,119	2015-02-23	105	1882	dnq	bd	1614		bd	bd	bd	bd	bd
SD3	18	-19,498	165,001	2015-02-24	0										
SD3	18	-19,498	165,001	2015-02-24	5	9413538	bd	bd	37574	bd	bd	bd	13299	295	1936
SD3	18	-19,498	165,001	2015-02-24	9	885034 5	bd	bd	27243	bd	bd	bd	13066	4075	bd
SD3	18	-19,498	165,001	2015-02-24	16	9969	bd	bd	1351	bd	bd	bd	bd	bd	bd
SD3	18	-19,498	165,001	2015-02-24	35		dnq	bd	14790	bd	bd	bd	bd	3047	1443
SD3	18	-19,498	165,001	2015-02-24	70	11467	242	bd	644		bd	bd	bd	bd	534
SD3	18	-19,498	165,001	2015-02-24	105	11657	bd	bd	551		bd	bd	dnq	bd	631
LDA	24	-19,212	164,688	2015-02-26	0										
LDA	24	-19,212	164,688	2015-02-26	4	65663	bd	bd	dnq		bd	bd	3109	bd	bd
LDA	24	-19,212	164,688	2015-02-26	9	1130319	bd	bd	dnq		bd	bd	bd	279	bd
LDA	24	-19,212	164,688	2015-02-26	16	776619	bd	bd	dnq		bd	bd	bd	bd	bd
LDA	24	-19,212	164,688	2015-02-26	35	645191	bd	bd	110		bd	bd	bd	bd	bd

LDA	24	-19,212	164,688	2015-02-26	70	55635	bd	bd	240		bd	bd	bd	bd	369
LDA	24	-19,212	164,688	2015-02-26	105	5583	bd	bd	dnq		bd	bd	bd	bd	287
SD4	69	-19,908	168,000	2015-03-04	0										
SD4	69	-19,908	168,000	2015-03-04	5	100275	11	bd	374	bd	bd	bd	27147	533	75
SD4	69	-19,908	168,000	2015-03-04	10	228214	dnq	bd	513	338	bd	bd	39270	1389	1154
SD4	69	-19,908	168,000	2015-03-04	15	437391	141	13	739	bd	bd	bd	60909	3656	1875
SD4	69	-19,908	168,000	2015-03-04	35	229535	8815	3413	3308	257	bd	156	343	bd	1198
SD4	69	-19,908	168,000	2015-03-04	70	4236	262	dnq	169		bd	bd	363	dnq	dnq
SD4	69	-19,908	168,000	2015-03-04	105	937	bd	bd	dnq		bd	bd	dnq	bd	bd
SD5	73	-22,001	170,000	2015-03-05	0	518768	dnq	dnq	22819		bd	bd	7373	527	541
SD5	73	-22,001	170,000	2015-03-05	5	420203	dnq	bd	7465		bd	bd	3378	241	65
SD5	73	-22,001	170,000	2015-03-05	10	895098	0	bd	18993		bd	bd	4016	1659	187
SD5	73	-22,001	170,000	2015-03-05	16	740172	0	bd	8751		bd	bd	7990	921	617
SD5	73	-22,001	170,000	2015-03-05	35	346365	845	124	6799		bd	21	4468	414	1252
SD5	73	-22,001	170,000	2015-03-05	70	6679	dnq	bd	589		bd	bd	665	dnq	382
SD5	73	-22,001	170,000	2015-03-05	105	dnq	37	dnq	477		bd	bd	bd	bd	bd

SD6	77	-21,368	172,135	2015-03-06	0	268530	bd	bd	2166610		bd	bd	10348	373	bd
SD6	77	-21,368	172,135	2015-03-06	5	655528	bd	bd	1167444		bd	bd	6172	157	46
SD6	77	-21,368	172,135	2015-03-06	10	502044	dnq	bd	1966461		bd	bd	5798	853	167
SD6	77	-21,368	172,135	2015-03-06	16	69929	8	dnq	2337849		bd	bd	1887	187	446
SD6	77	-21,368	172,135	2015-03-06	35	36042	1736	794	241049		bd	23	3057	204	599
SD6	77	-21,368	172,135	2015-03-06	70	5734	37554	2630	3571		3953	dnq	358	dnq	320
SD6	77	-21,368	172,135	2015-03-06	105	415	dnq	dnq	3215		bd	bd	239	dnq	170
SD7	81	-20,732	174,266	2015-03-07	0	276241	bd	bd	2783686		bd	bd	21030	857	1253
SD7	81	-20,732	174,266	2015-03-07	5	302432	bd	bd	1578780	bd	bd	bd	23420	554	dnq
SD7	81	-20,732	174,266	2015-03-07	12	370068	bd	bd	2369016	bd	bd	bd	30172	1559	329
SD7	81	-20,732	174,266	2015-03-07	21	57984	bd	bd	290878	dnq	bd	bd	6932	507	106
SD7	81	-20,732	174,266	2015-03-07	45	17829	1952	535	72523	dnq	bd	dnq	4976	324	128
SD7	81	-20,732	174,266	2015-03-07	90	1590	187	14	1431		bd	bd	dnq	bd	94
SD7	81	-20,732	174,266	2015-03-07	119	218	bd	bd	1062		bd	bd	bd	bd	bd
SD8	85	-20,695	176,397	2015-03-08	0	dnq	152	bd	8268		bd	bd	16132	bd	bd
SD8	85	-20,695	176,397	2015-03-08	4	3585834	dnq	bd	2910	bd	bd	bd	8578	bd	bd

SD8	85	-20,695	176,397	2015-03-08	12	1946086	dnq	bd	4267	bd	bd	bd	11183	bd	bd
SD8	85	-20,695	176,397	2015-03-08	21	282654	797	dnq	9113	bd	bd	bd	851	873	bd
SD8	85	-20,695	176,397	2015-03-08	45	193405	138058	1516	176758	dnq	11367	dnq	dnq	1100	dnq
SD8	85	-20,695	176,397	2015-03-08	90	5878	11315	96	852		dnq	bd	bd	bd	bd
SD8	85	-20,695	176,397	2015-03-08	135	1306	bd	bd	306		bd	bd	bd	bd	bd
SD9	89	-20,966	178,643	2015-03-09	0		120	dnq	163654		bd	bd	15950	1876	bd
SD9	89	-20,966	178,643	2015-03-09	5		49	dnq	160221	66	bd		24506	3672	357
SD9	89	-20,966	178,643	2015-03-09	12		56	dnq	227332	bd	bd	bd	29668	3886	2026
SD9	89	-20,966	178,643	2015-03-09	21		329	30	127739	bd	bd	bd	34626	28861	4694
SD9	89	-20,966	178,643	2015-03-09	45		7617	1283	163509	dnq	bd	bd	5467	1802	dnq
SD9	89	-20,966	178,643	2015-03-09	90		2249	242	5010		bd		dnq	dnq	bd
SD9	89	-20,966	178,643	2015-03-09	131		dnq	301	2120		bd	bd	dnq	bd	bd
SD10	93	-20,448	-178,513	2015-03-10	0	910515	bd	bd	1138		bd	bd	4910	856	131
SD10	93	-20,448	-178,513	2015-03-10	5	903433	bd	bd	761		bd	bd	7412	7926	481
SD10	93	-20,448	-178,513	2015-03-10	12	711040	bd	bd	1055		bd	bd	13656	3742	1413
SD10	93	-20,448	-178,513	2015-03-10	21	397017	bd	bd	712		bd	bd	7930	1789	3188

SD10	93	-20,448	-178,513	2015-03-10	45	127081	1658	122	18422		bd	bd	834	bd	797
SD10	93	-20,448	-178,513	2015-03-10	90	975	1502	130	315		bd	bd	bd	bd	bd
SD10	93	-20,448	-178,513	2015-03-10	133	dnq	dnq	dnq	281		bd	bd	346	bd	bd
SD11	97	-19,986	-175,667	2015-03-11	0	170749	bd	bd	13043		bd	bd	dnq	178	bd
SD11	97	-19,986	-175,667	2015-03-11	5	508743	dnq	dnq	32905		bd	bd	6441	406	bd
SD11	97	-19,986	-175,667	2015-03-11	12	267357	dnq	dnq	10236		bd	bd	663	368	bd
SD11	97	-19,986	-175,667	2015-03-11	21	350025	20	bd	34408		bd	bd	bd	dnq	bd
SD11	97	-19,986	-175,667	2015-03-11	44	28957	479	29	106565		bd	bd	1857	bd	bd
SD11	97	-19,986	-175,667	2015-03-11	90	309	493	53	266		bd	bd	3221	bd	153
SD11	97	-19,986	-175,667	2015-03-11	135	552	bd	bd	192		bd	bd	bd	bd	bd
SD12	101	-19,503	-172,798	2015-03-12	0	129711	bd	bd	115087		bd	bd	bd	bd	bd
SD12	101	-19,503	-172,798	2015-03-12	4	72883	dnq	dnq	129895		bd	bd	bd	bd	bd
SD12	101	-19,503	-172,798	2015-03-12	11	175793	dnq	bd	108798		bd	bd	735	dnq	bd
SD12	101	-19,503	-172,798	2015-03-12	19	459153	41	bd	377466		bd	bd	bd	191	bd
SD12	101	-19,503	-172,798	2015-03-12	45	294698	31279	5136	212707		2233	497	1091	dnq	bd
SD12	101	-19,503	-172,798	2015-03-12	85	dnq	108	dnq	315		bd	bd	bd	bd	dnq

SD12	101	-19,503	-172,798	2015-03-12	128	dnq	dnq	dnq	211		bd	bd	dnq	bd	bd
LDB	106	-18,241	-170,857	2015-03-15	0	288955	bd	bd	576		bd	bd	406	18	dnq
LDB	106	-18,241	-170,857	2015-03-15	5	189366	bd	bd	255	bd	bd	bd	404	dnq	dnq
LDB	106	-18,241	-170,857	2015-03-15	7	292950	bd	bd	1349	bd	bd	bd	585	dnq	dnq
LDB	106	-18,241	-170,857	2015-03-15	12	493288	bd	bd	1528	bd	bd	bd	823	dnq	dnq
LDB	106	-18,241	-170,857	2015-03-15	27	502542	bd	bd	1781	bd	bd	bd	4234	41	bd
LDB	106	-18,241	-170,857	2015-03-15	56	10461	12	dnq	126		bd	bd	14	bd	bd
LDB	106	-18,241	-170,857	2015-03-15	82	683	bd	bd	111		bd	bd	bd	bd	bd
SD13	152	-18,199	-169,073	2015-03-21	0										
SD13	152	-18,199	-169,073	2015-03-21	5	6409	bd	bd	9095	bd	bd	bd	dnq	dnq	bd
SD13	152	-18,199	-169,073	2015-03-21	15	51425	bd	bd	19649	bd	bd	bd	dnq	bd	bd
SD13	152	-18,199	-169,073	2015-03-21	25	14177	bd	bd	9236	bd	bd	bd	bd	bd	bd
SD13	152	-18,199	-169,073	2015-03-21	45	bd	bd	bd	328	bd	bd	dnq	38	bd	bd
SD13	152	-18,199	-169,073	2015-03-21	65	bd	bd	bd	182		bd	bd	bd	bd	bd
SD13	152	-18,199	-169,073	2015-03-21	85	dnq	bd	bd	181		bd	bd	76	bd	bd
LDC	160	-18,427	-165,923	2015-03-23	0	dnq	dnq	bd	4203		bd	bd	3877	181	168

LDC	160	-18,427	-165,923	2015-03-23	6	dnq	bd	bd	3643	bd	bd	bd	2997	872	307
LDC	160	-18,427	-165,923	2015-03-23	16	dnq	bd	bd	1757	bd	bd	bd	6349	471	1006
LDC	160	-18,427	-165,923	2015-03-23	27	dnq	dnq	dnq	1951	bd	bd	bd	3366	204	2032
LDC	160	-18,427	-165,923	2015-03-23	60	743	31978	85336	578549	bd	6187	3358	421	dnq	625
LDC	160	-18,427	-165,923	2015-03-23	120		dnq	bd	338		bd	bd	bd	bd	bd
LDC	160	-18,427	-165,923	2015-03-23	180		bd	bd	dnq		bd	bd	bd	bd	bd
SD14	208	-18,409	-162,998	2015-03-29	0	bd	bd	bd	349		bd	bd	dnq	bd	bd
SD14	208	-18,409	-162,998	2015-03-29	5	bd	bd	bd	bd		bd	bd	bd	bd	bd
SD14	208	-18,409	-162,998	2015-03-29	15	bd	bd	bd	dnq		bd	bd	dnq	bd	bd
SD14	208	-18,409	-162,998	2015-03-29	25	dnq	bd	bd	247		bd	bd	bd	dnq	bd
SD14	208	-18,409	-162,998	2015-03-29	56	bd	bd	bd	dnq		bd	bd	28	dnq	bd
SD14	208	-18,409	-162,998	2015-03-29	110	bd	bd	bd	183		bd	bd	106	dnq	bd
SD14	208	-18,409	-162,998	2015-03-29	165	bd	bd	bd	dnq		bd	bd	bd	bd	bd
SD15	211	-18,267	-160,000	2015-03-30	0	bd	bd	bd	180		bd	bd	bd	bd	bd
SD15	211	-18,267	-160,000	2015-03-30	6	dnq	bd	bd	122	bd	bd	bd	bd	bd	bd
SD15	211	-18,267	-160,000	2015-03-30	16	bd	bd	bd	dnq	bd	bd	bd	bd	bd	bd

SD15	211	-18,267	-160,000	2015-03-30	26	dnq	bd	bd	470	bd	bd	bd	bd	bd	bd
SD15	211	-18,267	-160,000	2015-03-30	58	bd	bd	bd	dnq	bd	bd	bd	bd	bd	bd
SD15	211	-18,267	-160,000	2015-03-30	116	bd	bd	bd	dnq		bd	bd	bd	bd	bd
SD15	211	-18,267	-160,000	2015-03-30	174	bd	bd	bd	dnq		bd	bd	bd	bd	bd
						bd	84	97					49	69	71
						total	120	120					120	120	120
						% of samples BD	70	80,8333333					40,8333333	57,5	59,16666667
						averagge when detected	309672	105632							
						so exclude 0's	8602	4592,695652							

Table S4a-b. Summary of correlation matrices (Spearman's Rho) for (a) the various target abundances (nifH gene copies L-1) and (b) environmental conditions. CC is the correlation coefficient, signifying the strength of the correlation, which can be either positive (+) or negative (-) and ranges from 0 (weak) to 1 (strong), while p is the significance value. Significant positive correlations are marked with light grey and significant negative correlations with dark grey.

(a) Parameter		UCYN-B	UCYN-A1	UCYN-A2	UCYN-A1 host	UCYN-A2 host	het-1	het-2	het-3	
Trichodesmium	*CC*	0.521**	-0.054	-0.018	-0.026	0.053	0.537**	0.569**	0.334**	
	p	<0.001	0.582	0.855	0.787	0.586	<0.001	<0.001	<0.001	
UCYN-B	CC		0.265**	0.243**	0.176	0.195*	0.571**	0.576**	0.405**	
	p		0.003	0.008	0.055	0.034	<0.001	<0.001	<0.001	
UCYN-A1	CC			0.791**	0.427**	0.400**	0.106	0.039	0.116	
	p			<0.001	<0.001	<0.001	0.247	0.674	0.205	
UCYN-A2	CC				0.498**	0.489**	0.075	-0.010	0.149	
	p				<0.001	<0.001	0.416	0.917	0.104	
UCYN-A1 host	CC					0.377**	-0.080	-0.081	-0.006	
	p					<0.001	0.382	0.380	0.949	
UCYN-A2 host	CC						0.057	-0.046	0.197*	
	p						0.539	0.621	0.033	
het-1	CC							0.726**	0.572**	
	p							<0.001	<0.001	
het-2	CC								0.583**	
	p								<0.001	

(b) Parameter		Depth (m)	Temp (˚C)	Flourescence (mg L^{-1})	PAR (mmol photons $m^{-2}s^{-2}$)	Salinity (PSU)	Oxygen (ml L^{-1})	DIP µM	DIN mM	DiSi mM
Trichodesmium	CC	-0.478**	0.477**	0.010	0.578**	-0.587**	0.127	-0.803**	-0.491**	-0.717**
	p	<0.001	<0.001	0.921	<0.001	<0.001	0.216	<0.001	<0.001	<0.001
UCYN-B	CC	-0.406**	0.355**	-0.098	0.356**	-0.424**	0.222*	-0.485**	-0.409**	-0.380**
	p	<0.001	<0.001	0.313	0.002	<0.001	0.021	<0.001	<0.001	<0.001
UCYN-A1	CC	0.240**	-0.315**	0.244*	-0.285*	0.243*	0.554**	-0.094	-0.055	-0.026
	p	0.008	0.001	0.011	0.015	0.011	<0.001	0.355	0.596	0.793
UCYN-A2	CC	0.309**	-0.313**	0.187	-0.343**	0.221*	0.584**	-0.112	-0.075	-0.028
	p	0.001	0.001	0.053	0.003	0.021	<0.001	0.269	0.470	0.779
UCYN-A1 host	CC	0.144	-0.129	0.029	-0.128	0.138	0.344**	0.008	-0.022	0.100
	p	0.116	0.182	0.765	0.284	0.154	<0.001	0.937	0.835	0.317
UCYN-A2 host	CC	0.090	-0.082	0.042	-0.110	0.100	0.298**	-0.060	-0.069	0.055
	p	0.330	0.401	0.673	0.365	0.310	0.002	0.555	0.511	0.581
het-1	CC	-0.476**	0.400**	-0.098	0.480**	-0.370**	0.141	-0.613**	-0.487**	-0.548**
	p	<0.001	<0.001	0.311	<0.001	<0.001	0.146	<0.001	<0.001	<0.001
het-2	CC	-0.464**	0.390**	-0.171	0.417**	-0.452**	0.048	-0.559**	-0.410**	-0.479**
	p	<0.001	<0.001	0.076	<0.001	<0.001	0.623	<0.001	<0.001	<0.001
het-3	CC	-0.154	0.159	0.004	0.165	-0.266**	0.125	-0.261**	-0.156	-0.091
	p	0.093	0.100	0.965	0.167	0.005	0.197	0.009	0.134	0.362

Table S5. Summary of the microscopy cell abundances and qualitative observations of various diazotrophs. Trichodesmium spp. as free filaments, colonies, and T. pelagicum were enumerated at LD A, B and C.

	Station	Depth (m)	Light (%)	*Trichodesmium spp.*		*T. pelagicum*	*Richelia*	*C. watsonii like*	Qualitative observations
sample ID	LD			free filaments L^{-1}	colonies L^{-1}	free filaments L^{-1}	free filaments L^{-1}	cells L^{-1}	
8712	A	0	100	5.8*		0.4*	0.4*		*Trichodesmium* filaments are short and/or broken (5-10 cells); *C. watsonii*-like cells present but difficult to distinguish due to poor fluorescence and interference with background of cellular debris
8715	A	4	75	3.4*			0.2*		Several *Trichodesmium* filaments under viral attach; *C. watsonii*-like cells present but cell diameter is smaller than usual (e.g.> 3um).
8718	A	6	54	8*		1.4*			*Trichodesmium* filaments are short and/or broken (5-10 cells); lots of cellular debris
8721	A	16	36	5.2*				4416,5	
8724	A	0	100	4.4*		1.2*			
8727	A	5	75	86,4	0.2*	1*			*Trichodesmium* filaments are short and/or broken (5-10 cells)
8730	A	9	54	8.4*					*Trichodesmium* filaments are short and/or broken (5-10 cells)

8733	A	16	36	9.8*					Many free *Richelia*-like cells organized in clumps.
8797	B	0	100	1086,8	5.6*	13,2			*Trichodesmium*filaments forms few colonies; some short and/or broken (5-10 cells) together with entire filaments (> 10 cells)
8800	B	5	75	663,6	1.8*	14,2			*Trichodesmium*filaments forms few colonies; some short and/or broken (5-10 cells) together with entire filaments (> 10 cells)
8803	B	7	54	1529,7	5.4*	9*			*Trichodesmium*filaments forms few colonies; some short and/or broken (5-10 cells) together with entire filaments (> 10 cells)
8806	B	12	36	1627,8	4.2*	20,2			*Trichodesmium*filaments forms few colonies; some short and/or broken (5-10 cells) together with entire filaments (> 10 cells)
8815	B	0	100	752	2.2*	32,2			
8818	B	4	75	821,9	2*	29,6			
8821	B	7	54	960,5	3.8*	23,2			
8824	B	12	36	748,3	2*	21,6			

8847	C	0	100						Low biomass; lots of cellular debris (broken frustules); dead copepods
8850	C	6	75	0.6*					high density of picoeukaryotes but not evenly distributed on filter
8853	C	16	54	0.2*					less density of picoeukaryotes than 75% light
8856	C	26	36	0.8*					low general biomass
8865	C	0	100	4*					lots of cellular debris
8868	C	5	75	0.6*					high density of picoeukaryotes
8871	C	7	54	3*					less density of picoeukaryotes than 75% light
8874	C	13	36	1.4*					
8876	C	27	10						presence of pico-eukaryotes; cellular debris
***, indicates that counts were less than 50 per filter (area=1734 mm2)**									

Table S6. Summary of environmental factors influencing the distribution of various diazotrophic targets reported here in the WTSP, and the global datasets. Parameters with positive, negative or no significant correlation are designated with +, - and 0, respectively (Spearman's Rho $p<0.05$): Parameters noted as nr have no recorded data, and parameters noted as bd have been sampled but were below detection. The following region abbreviations are used: NEP (North East Pacific), WTSP (South West Pacific), TA (Tropical Atlantic), NA (North Atlantic), WTNA (Western Tropical North Atlantic, EEA (East Equatorial Atlantic), NSCS (Northern South China Sea) and SSCS (Southern South China Sea). * and ** marks positive and negative correlations respectively, which have small sample sizes ($N<33$) and are nearly significant ($p<0.095$). The overall between parameters effect (<0.2=low, 0.2-0.5=moderate, >0.5=high) is the estimate of the effect size in a meta-analysis, where † marks statistical significance ($p<0.05$).

Parameter	Region	Study	Depth	Temp	Chl a	Salinity	DIP	DIN	*Trichodesmium*	UCYN-A	UCYN-B	Het-1	Het-2
Trichodesmium	NEP	Church et al. 2005	-	nr	nr	nr	nr	nr		+	-	0	nr
		Church et al. 2008	0	0	0	nr	nr	0		+	+	0*	+
	SWP	Moisander et al. 2010 (Tropical)	-	+	0	-	-	-		0*	+	+	nr
		Moisander et al. 2010 (Sub-tropical)	-	+	0	0	-	-		+	+	+	nr
		This study	-	+	0	-	-	-		0	+	+	+
	TA	Goebel et al. 2010	-	+	nr	-	-	0		0	0	0*	0
	NA	Langlois et al. 2008	-	+	nr	-	-	-		+	+	nr	nr

		Benavides et al. 2016	nr	0	0	0	0	0		-	nr	0	nr
	WTNA	Foster et al. 2007	-	0	nr	0	nr	nr		+	+	+	+
	EEA	Foster et al. 2009	0	+	nr	-	nr	nr		0	+	0	0
	NSCS	Kong et al. 2011	0	0	0	0	0	0		0	0*	0	nr
	SSCS	Moisander et al. 2008	-	nr	nr	nr	nr	nr		0	+	0	+
		Bombar et al. 2011	0	0	0	0	0	0		bd	0*	+	+
Overall	Global	ALL	-0,41†	0,56†	-0,03	-0,33†	-0,56†	-0,39†		0,25†	0,50†	0,52†	0,55†
Parameter	Region	Study	Depth	Temp	Chl a	Salinity	DIP	DIN	*Trichodesmium*	UCYN-A	UCYN-B	Het-1	Het-2
UCYN-A	NEP	Church et al. 2005	-	nr	nr	nr	nr	nr	+		-	0	nr
		Church et al. 2008	0	0	0	nr	nr	0	+		+	+	0
	SWP	Moisander et al. 2010 (Tropical)	-	0	0	0	-	0	0*		+	0	nr
		Moisander et al. 2010 (Sub-tropical)	-	+	0	0	-	-	+		+	+	nr

		This study	+	-	+	+	0	0	0		+	0	0
	TA	Goebel et al. 2010	-	0	nr	+	-	0	0		+	0	0
	NA	Langlois et al. 2008	0	0	nr	+	-	-	+		+	nr	nr
		Benavides et al. 2016	nr	-	+	0	0	0	-		nr	0	nr
	WTNA	Foster et al. 2007	0	0	nr	0	nr	nr	+		+	+	0
	EEA	Foster et al. 2009	0	0	nr	0	nr	nr	0		0	0	0
	NSCS	Kong et al. 2011	-	+	0	-	-	-	0		+	+	nr
	SSCS	Moisander et al. 2008	0	nr	nr	nr	nr	nr	0		0	0	0
		Bombar et al. 2011	bd	bd	bd	bd	bd	bd	bd		bd	bd	bd
Overall	Global	ALL	-0,28†	0,09	0,02	0,09	-0,34†	-0,32†	0,25†		0,35†	0,28†	0,03
Parameter	Region	Study	Depth	Temp	Chl a	Salinity	DIP	DIN	*Trichodesmium*	UCYN-A	UCYN-B	Het-1	Het-2
UCYN-B	NEP	Church et al. 2005a	0	nr	nr	nr	nr	nr	-	-		-	nr
		Church et al. 2008	0	0	0	nr	nr	0	+	+		+	+

	SWP	Moisander et al. 2010 (Tropical)	-	+	-	-	-	-	+	+		+	nr
		Moisander et al. 2010 (Sub-tropical)	-	+	-	-	-	-	+	+		+	nr
		This study	-	+	0	-	-	-	+	+		+	+
	TA	Goebel et al. 2010	0	0	nr	0	0	0	0	+		0	0
	NA	Langlois et al. 2008	0	0	0	nr	-	-	+	+		nr	nr
	WTNA	Foster et al. 2007	0	+	nr	0	nr	nr	+	+		+	+
	EEA	Foster et al. 2009	0	+	nr	0	nr	nr	+	0		0	0
	NSCS	Kong et al. 2011	-	+	-	-	-	-	0*	+		+	nr
	SSCS	Moisander et al. 2008	-	nr	nr	nr	nr	nr	+	0		0	0
		Bombar et al. 2011	0*	0	0**	0*	0**	0	0*	bd		+	0
Overall	Global	ALL	-0,32†	0,47†	-0,25†	-0,20	-0,40†	-0,50†	0,50†	0,35†		0,38†	0,29†
Parameter	Region	Study	Depth	Temp	Chl a	Salinity	DIP	DIN	*Trichodesmium*	UCYN-A	UCYN-B	Het-1	Het-2

Het-1	NEP	Church et al. 2005	0	nr	nr	nr	nr	nr	0	0	-		nr
		Church et al. 2008	0	0	0	nr	nr	0	0*	+	+		0*
	SWP	Moisander et al. 2010 (Tropical)	-	+	0	-	-	-	+	0	+		nr
		Moisander et al. 2010 (Sub-tropical)	-	+	0**	0**	-	-	+	+	+		nr
		This study	-	+	0	-	-	-	+	0	+		+
	TA	Goebel et al. 2010	0	0	nr	0	nr	nr	0*	0	0		0*
	NA	Benavides et al. 2016	nr	0	0	0	0	0	0	0	nr		nr
	WTNA	Foster et al. 2007	-	+	nr	-	nr	nr	+	+	+		+
	EEA	Foster et al. 2009	0**	0	nr	0	nr	nr	0	0	0		0
	NSCS	Kong et al. 2011	-	+	0	-	-	-	0	+	+		nr
	SSCS	Moisander et al. 2008	0	nr	nr	nr	nr	nr	0	0	0		0
		Bombar et al. 2011	+	-	0**	+	-	-	+	bd	+		+

Overall	Global	ALL	-0,37†	0,30†	-0,19†	-0,22†	-0,62†	-0,51†	0,52†	0,28†	0,41†		0,48†
Parameter	Region	Study	Depth	Temp	Chl a	Salinity	DIP	DIN	*Trichodesmium*	UCYN-A	UCYN-B	Het-1	Het-2
Het-2	NEP	Church et al. 2008	0*	0	0	nd	nd	nd	+	0	+	0*	
	SWP	This study	-	+	0	-	-	-	+	0	+	+	
	TA	Goebel et al. 2010	0	+	nd	0	nd	nd	0	0	0	0*	
	WTNA	Foster et al. 2007	-	0	nd	-	nd	nd	+	0	+	+	
	TEA	Foster et al. 2009	0	0	nd	0	nd	nd	0	0	0	0	
	SSCS	Moisander et al. 2008	0	nd	nd	nd	nd	nd	+	0	0	0	
		Bombar et al. 2011	0	0	0	0	0	0**	+	UD	0	+	
Overall	Global	ALL	-0,15	0,30†	-0,16	-0,31†	-0,4	-0,34†	0,55†	0,03	0,29†	0,48†	