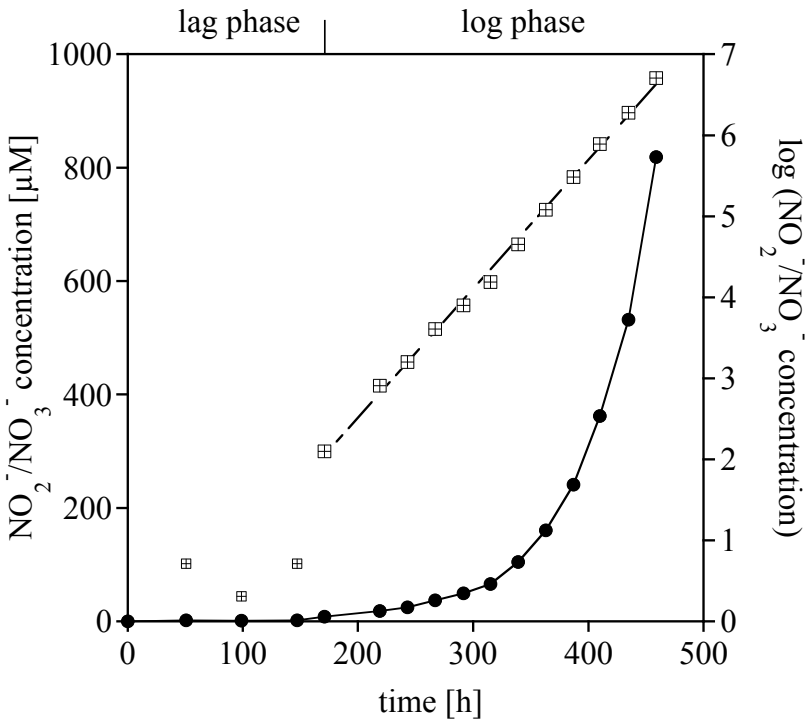

FIGURE S1: NO_2^-/NO_3^- concentration and log (NO_2^-/NO_3^- concentration) in an enrichment culture over time. The growth rate of the culture is calculated as the linear increase of the log transformed the NO_2^-/NO_3^- concentration over time. The lag phase was determined as the time before the culture started to grow logarithmic.

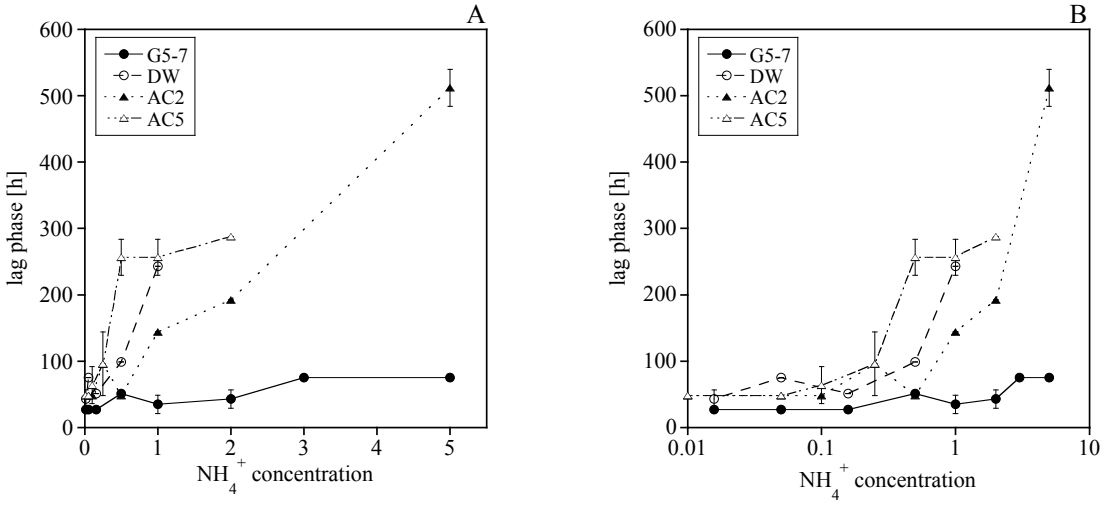

FIGURE S2: Influence of NH_4^+ concentration on the lag phase before onset of logarithmic growth in the enrichment cultures AOA-AC2; AOA-AC5, AOA-DW, and AOB-G5-7 (mean ± SD; n=3). A: NH_4^+ concentration linear scale; B: NH_4^+ concentration logarithmic scale.

TABLE S1: Primers and PCR conditions used in this study.

	Primer	Anneal. temp	# cycles
AOA-amoA (5)	Arch amoA F: 5'-STA ATG GTC TGG CTT AGA CG-3' Arch amoA R: 5'-GCG GCC ATC CAT CTG TAT GT-3'	53	35
Archaeal 16S rRNA (4, 6)	Arch 109F: 5'-ACK GCT CAG TAA CAC GT-3' Arch 915R: 5'-YCC GGC GTT GAM TCC AAT T-3'	46	30
AOB-amoA (10)	amoA-1F: 5'-GGG GTT TCT ACT GGT GGT-3' amoA-2R KS: 5'-CCC CTC KGS AAA GCC TTC TTC-3'	55	35
AOB-16S rRNA (7)	CTO 189F-A: 5'-GGA GAA AAG CAG GGG ATC G-3' CTO 189F-B: 5'-GGA GGA AAG CAG GGG ATC G-3' CTO 189F-C: 5'-GGA GGA AAG TAG GGG ATC G-3' CTO 654R: 5'-CTA GCY TTG TAG TTT CAA ACG C-3'	57.5	35
M13-cloning	M13-F: 5'-GTA AAA CGA CGG CCA G-3' M13-R: 5'-CAG GAA ACA GCT ATG AC-3'	50	30

TABLE S2: Oligonucleotide probes used for CARD-FISH

Probe	Sequence (5'-3')	Reference
Eub338I (Bacteria)	GCTGCCTCCCGTAGGAGT	(1)
Eub338II (Bacteria)	GCAGCCACCCGTAGGTGT	(2)
Eub338III (Bacteria)	GCTGCCACCCGTAGGTGT	(2)
Cren 554 (Crenarchaeota)	TTAGGCCCAATAATCMTCCT	(8)
Ntspa712 (Nitrospira)	CGCCTTCGCCACCGGCCTTCC Competitor: CGCCTTCGCCACCGGTGTTCC	(3)
AOB NSO1225	CGCCATTGTATTACGTGTGA	(9)
AOB NSO156	TATTAGCACATCTTTCGAT	(9)

TABLE S3: Influence of the NH_4^+ concentration on the growth rates [h^{-1}] of the enrichment culture AOA-AC2, AOA-AC5, AOA-DW and AOB-G5-7 (data are similar to data in Figure 2) (mean ± SD, n=3; different letters behind values indicate significant differences between values determined by one-way ANOVA followed by Tukey test; $P < 0.05$).

NH_4^+ [mM]	AOA-AC2	AOA-AC5	AOA-DW	AOB-G5-7
0.01	0.020 ± 0.002 ^{a}	0.023 ± 0.003 ^{a}		
0.0158			0.023 ± 0.003 ^{a}	0.030 ± 0.002 ^{a}
0.05	0.019 ± 0.001 ^{ab}	0.021 ± 0.000 ^{ab}	0.017 ± 0.000 ^{b}	0.042 ± 0.000 ^{b}
0.1	0.017 ± 0.000 ^{ab}	0.020 ± 0.001 ^{bcd}		
0.158			0.017 ± 0.000 ^{b}	0.051 ± 0.004 ^{bc}
0.25	0.017 ± 0.001 ^{ab}	0.020 ± 0.001 ^{abc}		
0.5	0.017 ± 0.002 ^{ab}	0.018 ± 0.001 ^{bcd}	0.016 ± 0.000 ^{b}	0.057 ±0.005 ^{cd}
1	0.017 ± 0.001 ^{ab}	0.020 ± 0.001 ^{ab}	0.016 ± 0.000 ^{b}	0.059 ± 0.003 ^{cd}
2	0.015 ± 0.002 ^{b}	0.016 ± 0.001 ^{cd}		0.060 ± 0.005 ^{cd}
3				0.065 ± 0.004 ^{d}
5		0.016 ± 0.000 ^{d}		0.061 ± 0.003 ^{d}

TABLE S4: Influence of NH_4^+ concentration on the lag phase [h] before onset of logarithmic growth in the enrichment cultures AOA-AC2; AOA-AC5, AOA-DW, and AOB-G5-7 (data are similar to data in Figure S3; mean ± SD, n=3; different letters behind values indicate significant differences between values determined by one-way ANOVA followed by Tukey test; $P < 0.05$).

NH_4^+ [mM]	AOA-AC2	AOA-AC5	AOA-DW	AOB-G5-7
0.01	48.0 ± 0.0 [a]	48.0 ± 0.0 [a]		
0.0158			43.0 ± 13.9 [a]	27.0 ± 0.0 [a]
0.05	48.0 ± 0.0 [a]	48.0 ± 0.0 [a]	75.5 ± 0.0 [a]	27.0 ± 0.0 [a]
0.1	64.0 ± 27.7 [a]	48.0 ± 0.0 [a]		
0.158			51.0 ± 0.0 [b]	27.0 ± 0.0 [a]
0.25	96.0 ± 0.0 [a]	96.0 ± 0.0 [ab]		
0.5	256.5 ± 27.3 [b]	48.0 ± 0.0 [a]	99.0 ± 0.0 [c]	51.0 ± 0.0 [b]
1	256.5 ± 27.3 [b]	144.0 ± 0.0 [bc]	243.0 ± 0.0 [d]	35.0 ± 13.9 [ab]
2	288.0 ± 0.0 [b]	192.0 ± 0.0 [c]		43.0 ± 13.9 [ab]
3				75.5 ± 0.0 [c]
5		512.0 ± 27.7 [d]		75.5 ± 0.0 [c]

TABLE S5: Influence of the calculated O_2 concentrations in the headspace of the bottle on the growth rates [h^{-1}] of the enrichment cultures AOA-AC2, AOA-AC5, AOA-DW, and AOB-G5-7 (data are similar to data in Figure 3; mean ± SD, n=3; different letters behind values indicate significant differences between values determined by one-way ANOVA followed by Tukey test; $P < 0.05$).

O_2 [%]	AC2	AC5	DW	G5-7
0.5	0.000 ± 0.000 ^{a}	0.005 ± 0.000 ^{a}	0.014 ± 0.004 ^{a}	0.010 ± 0.000 ^{a}
1	0.008 ± 0.001 ^{b}	0.008 ± 0.000 ^{b}	0.016 ± 0.000 ^{a}	0.018 ± 0.001 ^{b}
2	0.011 ± 0.001 ^{bc}	0.009 ± 0.001 ^{c}	0.015 ± 0.001 ^{a}	0.031 ± 0.003 ^{c}
21	0.013 ± 0.001 ^{c}	0.008 ± 0.000 ^{bc}	0.019 ± 0.003 ^{a}	0.045 ± 0.002 ^{d}

TABLE S6: Influence of the pH value on the growth rates [h^{-1}] of the enrichment cultures AOA-AC2, AOA-AC5, AOA-DW, and AOB-G5-7 (data are similar to data in Figure 4; mean ± SD, n=3; different letters behind values indicate significant differences between values determined by one-way ANOVA followed by Tukey test; $P < 0.05$).

pH	AC2	AC5	DW	G5-7
6	0.000 ± 0.000 ^{a}	0.010 ± 0.000 ^{ab}	0.017 ± 0.001 ^{a}	0.034 ± 0.003 ^{a}
6.5	0.011 ± 0.001 ^{bc}	0.011 ± 0.001 ^{abc}	0.018 ± 0.001 ^{ad}	0.046 ± 0.004 ^{b}
7	0.013 ± 0.000 ^{d}	0.013 ± 0.001 ^{c}	0.024 ± 0.000 ^{b}	0.049 ± 0.000 ^{b}
7.5	0.012 ± 0.000 ^{cd}	0.011 ± 0.001 ^{abc}	0.022 ± 0.001 ^{bc}	0.051 ± 0.004 ^{b}
8	0.010 ± 0.000 ^{b}	0.012 ± 0.000 ^{bc}	0.020 ± 0.002 ^{cd}	0.047 ± 0.005 ^{b}
8.5	0.005 ± 0.000 ^{e}	0.008 ± 0.000 ^{a}	0.020 ± 0.001 ^{cd}	0.025 ± 0.001 ^{c}
9	0.006 ± 0.000 ^{e}	0.010 ± 0.002 ^{ab}	0.020 ± 0.001 ^{cd}	0.018 ± 0.001 ^{c}

TABLE S7: Influence of white, red, and blue light with the intensity of 30 µmol photons m^{-2} s^{-1} and blue light with the intensity of 3 µmol photons m^{-2} s^{-1} on the growth rates [h^{-1}] of the enrichment cultures AOB-G5-7 (data are similar to data in Figure 5; mean ± SD, n=3; different letters behind values indicate significant differences between values determined by one-way ANOVA followed by Tukey test; $P < 0.05$).

G5-7	white	red	blue	blue low intensity
light	0.056 ± 0.001 [a]	0.051 ± 0.005 [a]	0.000 ± 0.000 [a]	0.057 ± 0.004 [a]
light -> dark	0.056 ± 0.004 [a]	0.047 ± 0.002 [a]	0.051 ± 0.002 [b]	0.068 ± 0.004 [b]
dark -> light	0.058 ± 0.001 [a]	0.049 ± 0.002 [a]	0.064 ± 0.004 [c]	0.055 ± 0.002 [a]
dark	0.055 ± 0.001 [a]	0.045 ± 0.002 [a]	0.066 ± 0.004 [c]	0.063 ± 0.003 [ab]

TABLE S8: Influence of white, red, and blue light with the intensity of 30 µmol photons m^{-2} s^{-1} and blue light with the intensity of 3 µmol photons m^{-2} s^{-1} on the growth rates [h^{-1}] of the enrichment cultures AOA-DW (data are similar to data in Figure 5; mean ± SD, n=3; different letters behind values indicate significant differences between values determined by one-way ANOVA followed by Tukey test; $P < 0.05$).

	white	red	blue	blue low intensity
light	0.000 ± 0.000 [a]	0.012 ± 0.000 [a]	0.000 ± 0.000 [a]	0.011 ± 0.001 [a]
light -> dark	0.000 ± 0.000 [a]	0.012 ± 0.001 [a]	0.000 ± 0.000 [a]	0.013 ± 0.001 [bc]
dark -> light	0.018 ± 0.000 [b]	0.018 ± 0.001 [b]	0.018 ± 0.001 [b]	0.012 ± 0.001 [ab]
dark	0.017 ± 0.001 [b]	0.016 ± 0.000 [c]	0.020 ± 0.000 [c]	0.015 ± 0.001 [c]

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