

Supplement of Biogeosciences, 13, 5527–5539, 2016
<http://www.biogeosciences.net/13/5527/2016/>
doi:10.5194/bg-13-5527-2016-supplement
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Biogeosciences  Open Access

Supplement of

Seasonal changes in the D / H ratio of fatty acids of pelagic microorganisms in the coastal North Sea

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Figure legends Supplementary

Figure S1

Phylogenetic tree of 16S rRNA gene sequence reads assigned to *Bacteroidetes*. Scale bar indicates 0.10 % estimated sequence divergence. Groups containing sequences are highlighted.

Figure S2

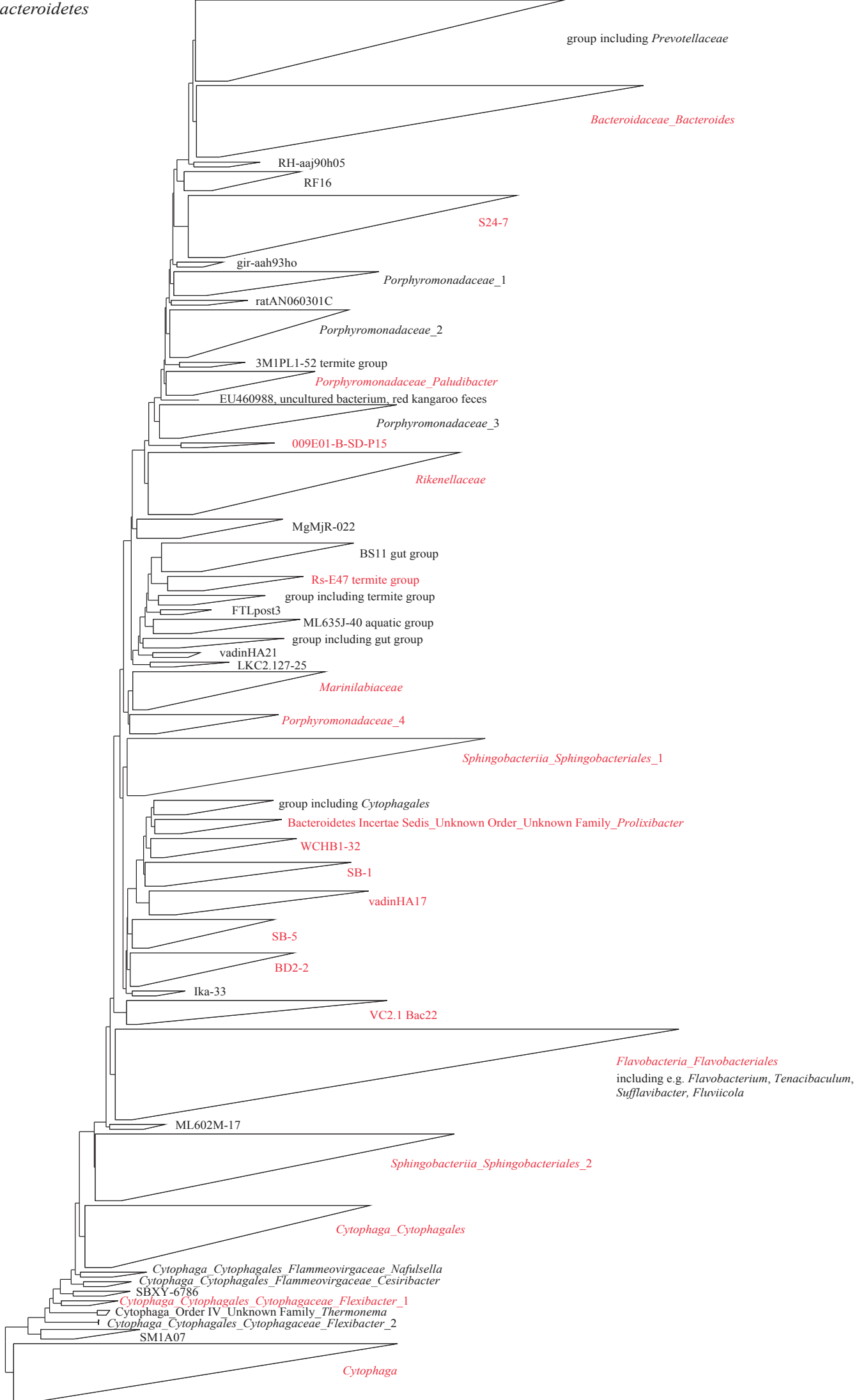
Phylogenetic tree of 16S rRNA gene sequence reads assigned to *Alphaproteobacteria*. Scale bar indicates 0.10 % estimated sequence divergence. Groups containing sequences are highlighted.

Figure S3

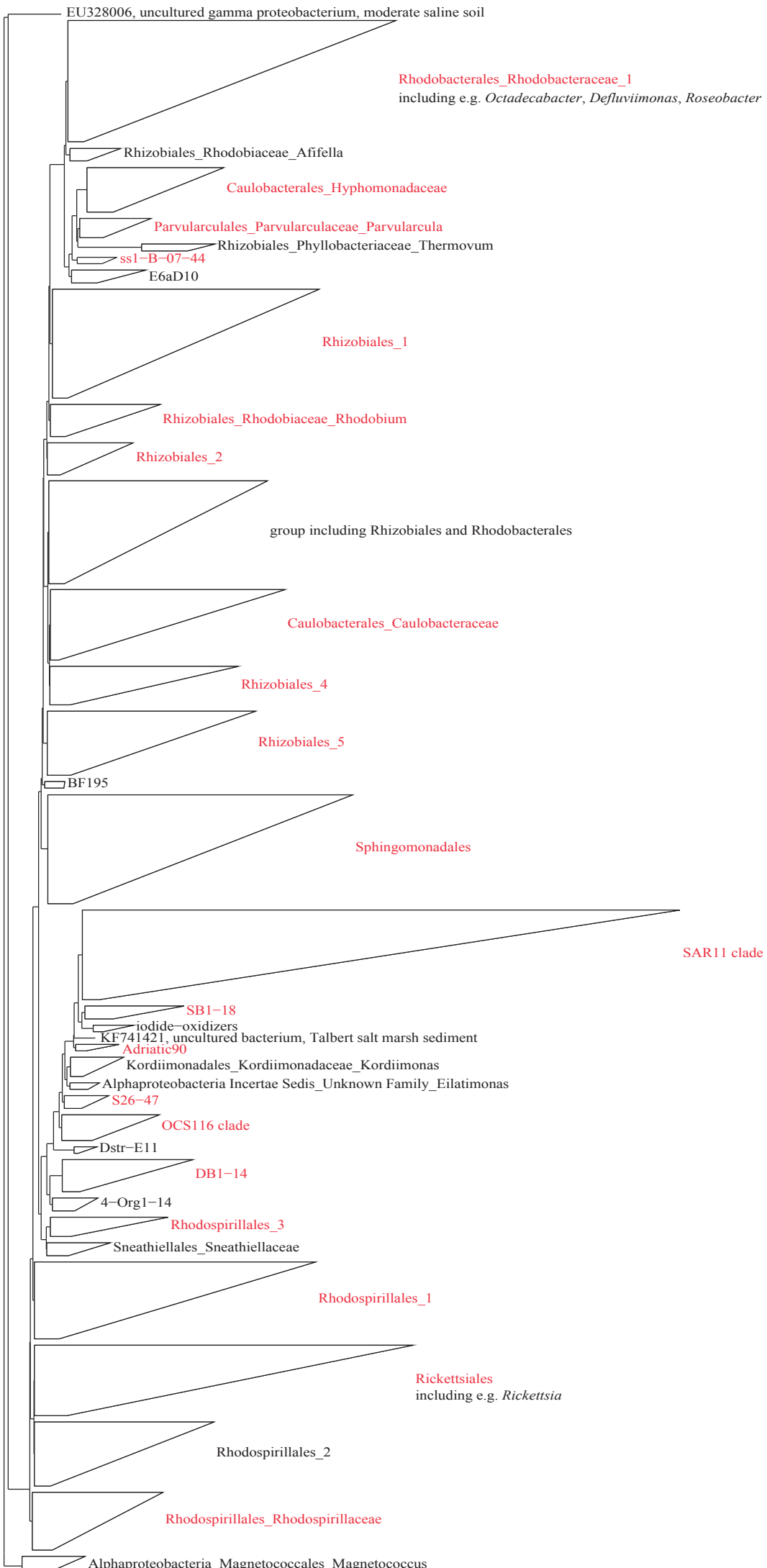
Phylogenetic tree of 16S rRNA gene sequence reads assigned to *Gammaproteobacteria*. Scale bar indicates 0.10 % estimated sequence divergence. Groups containing sequences are highlighted.

Figure S4

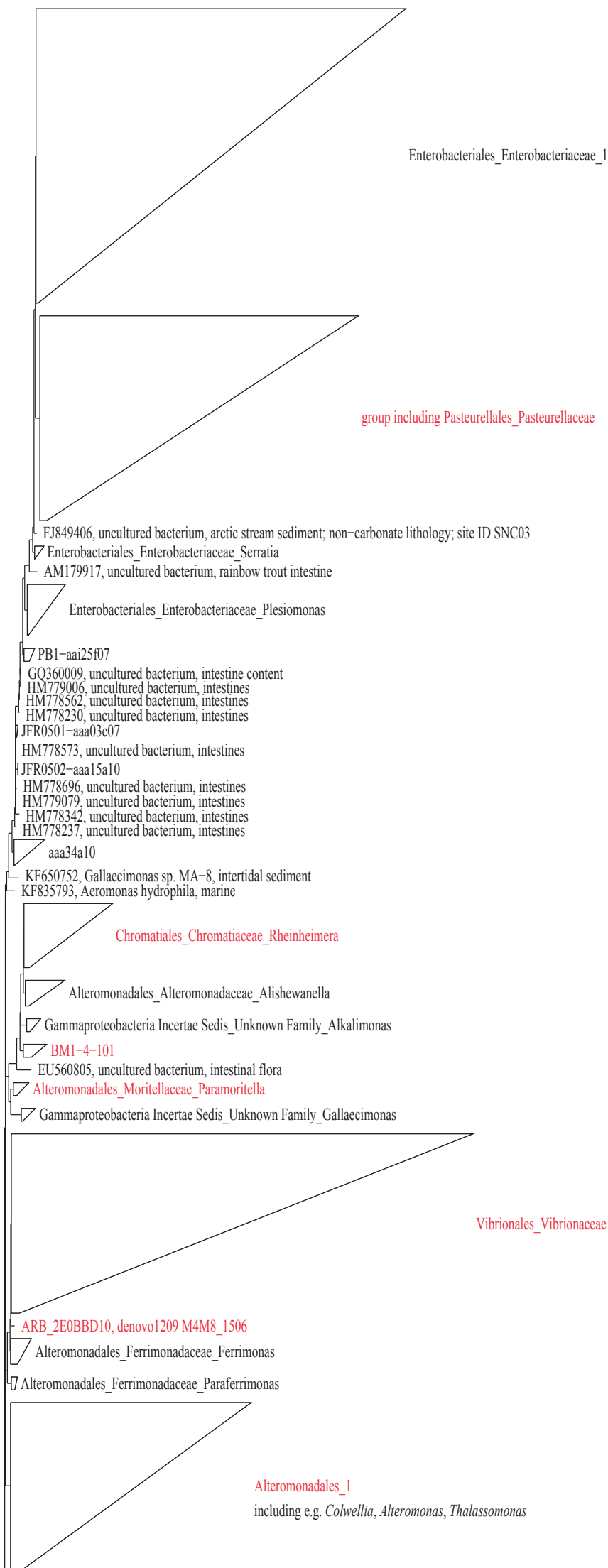
δD_{water} versus salinity of North Sea SPM sampled in 2013.

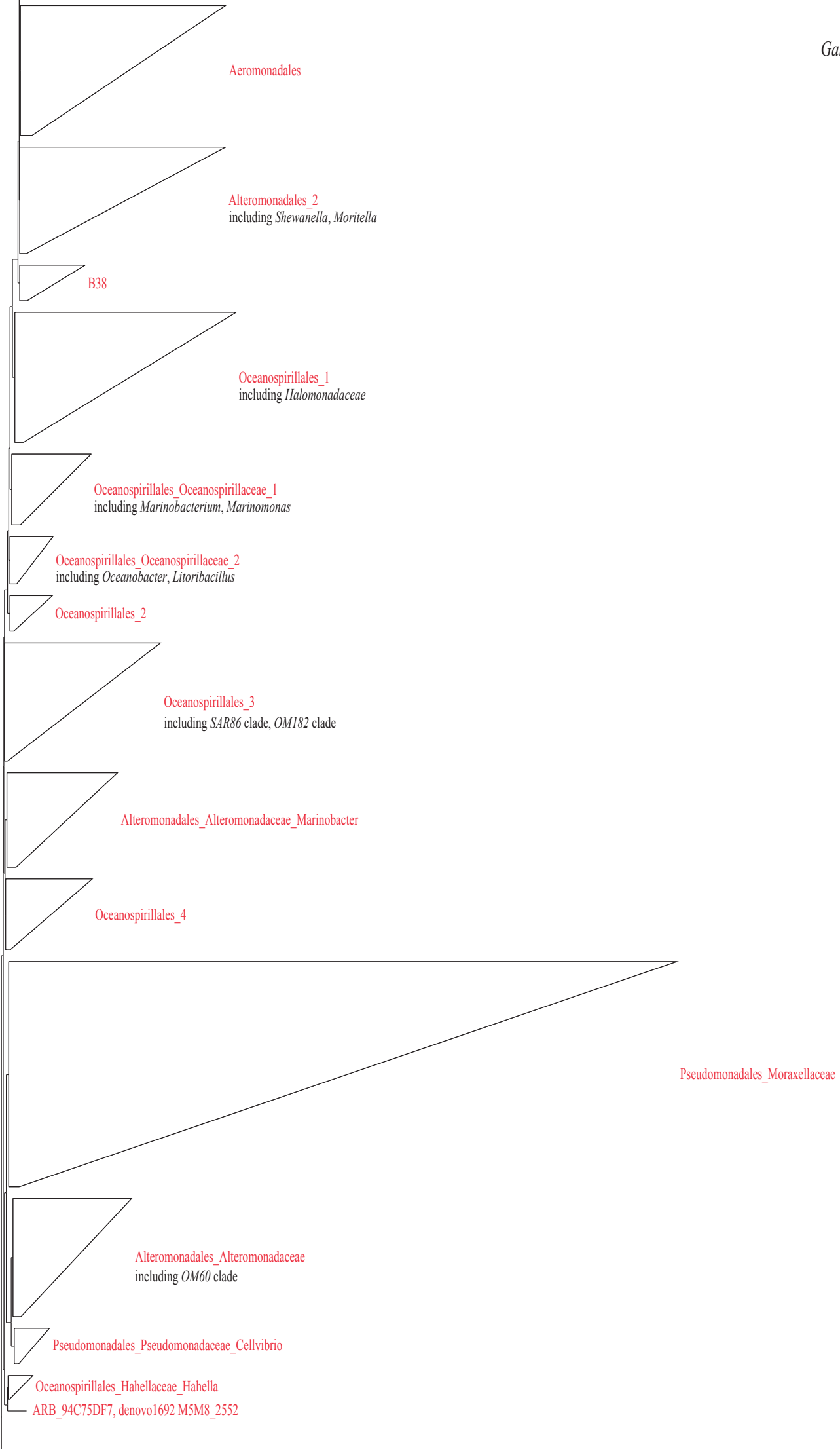


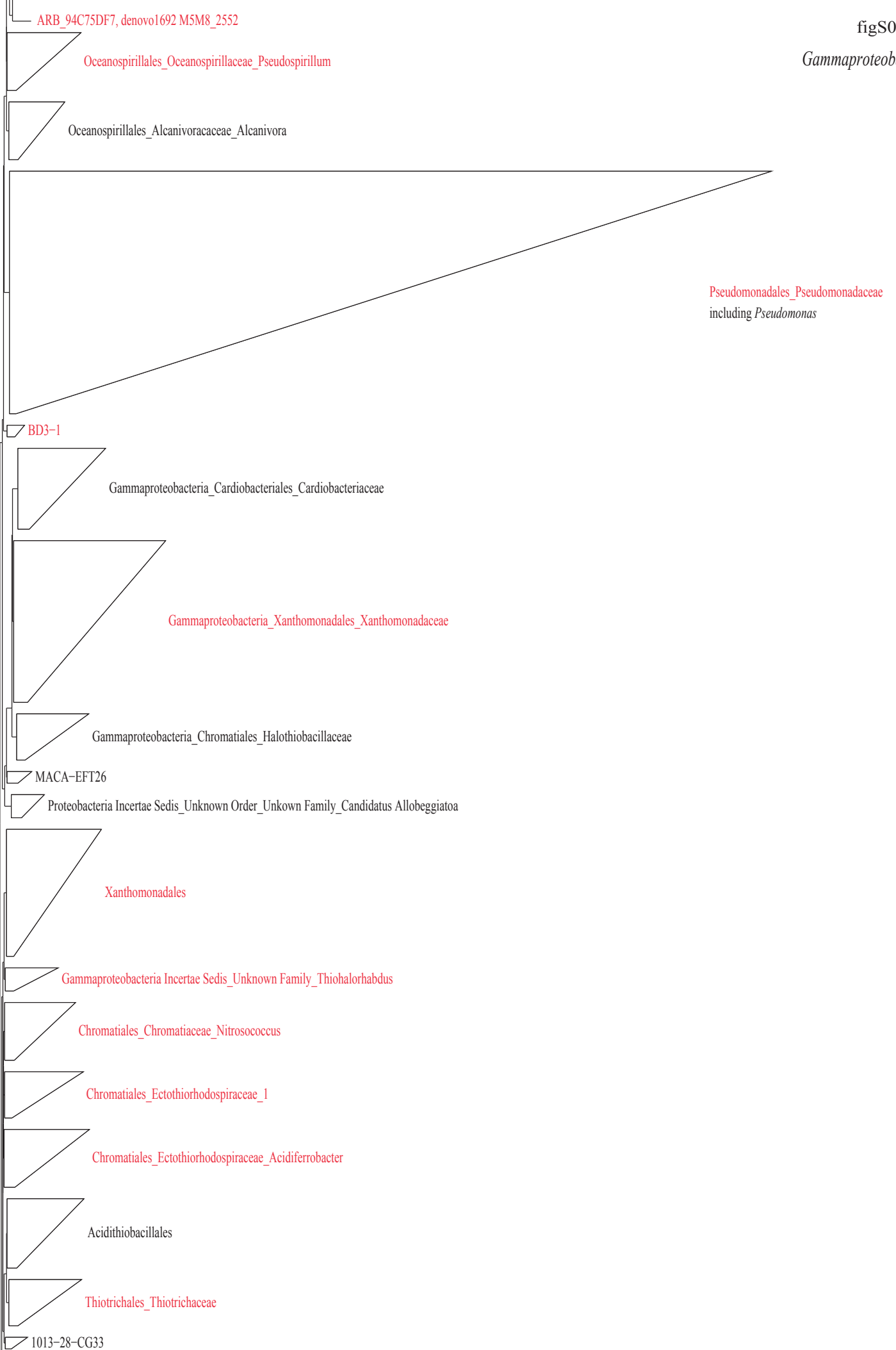
Alphaproteobacteria

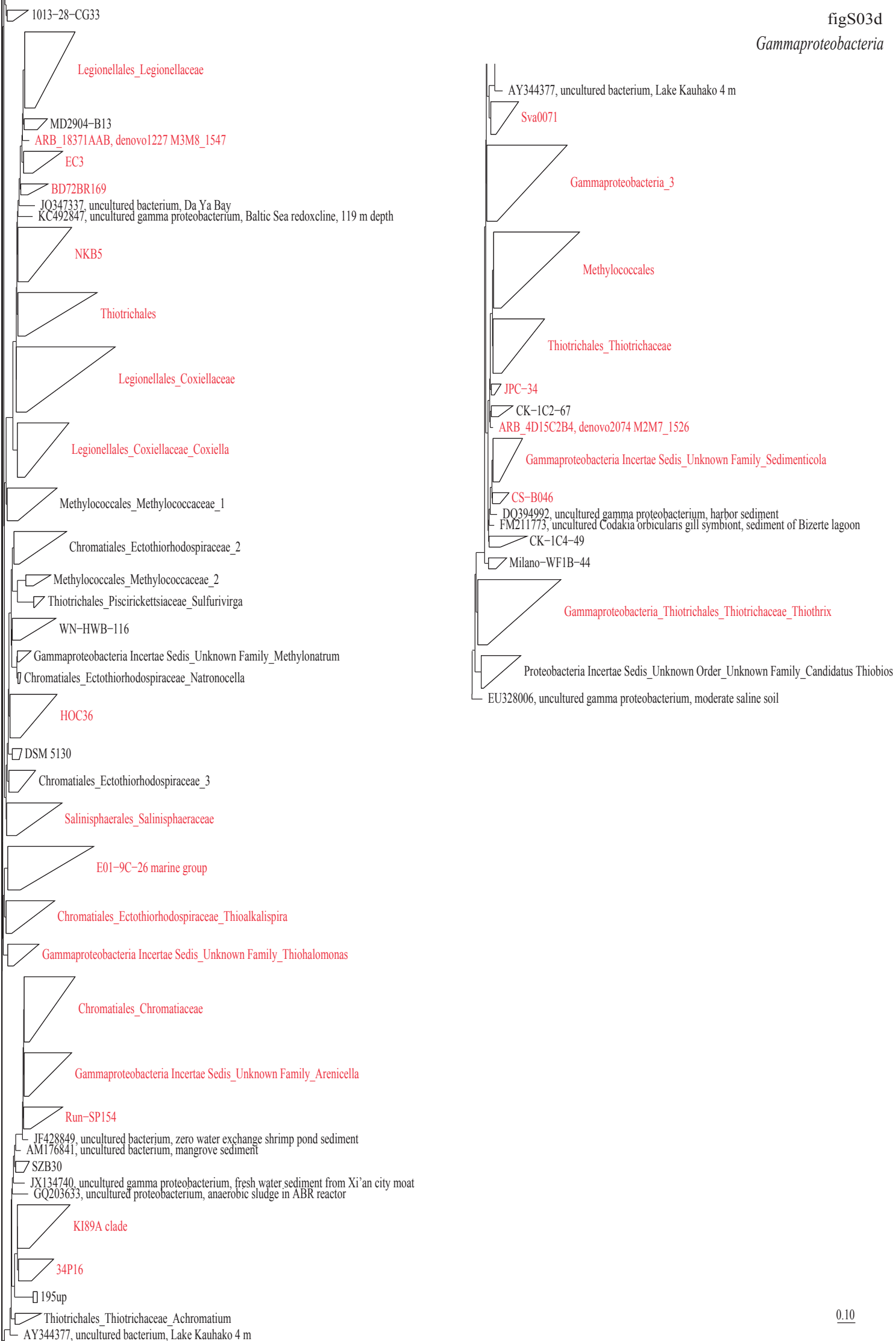


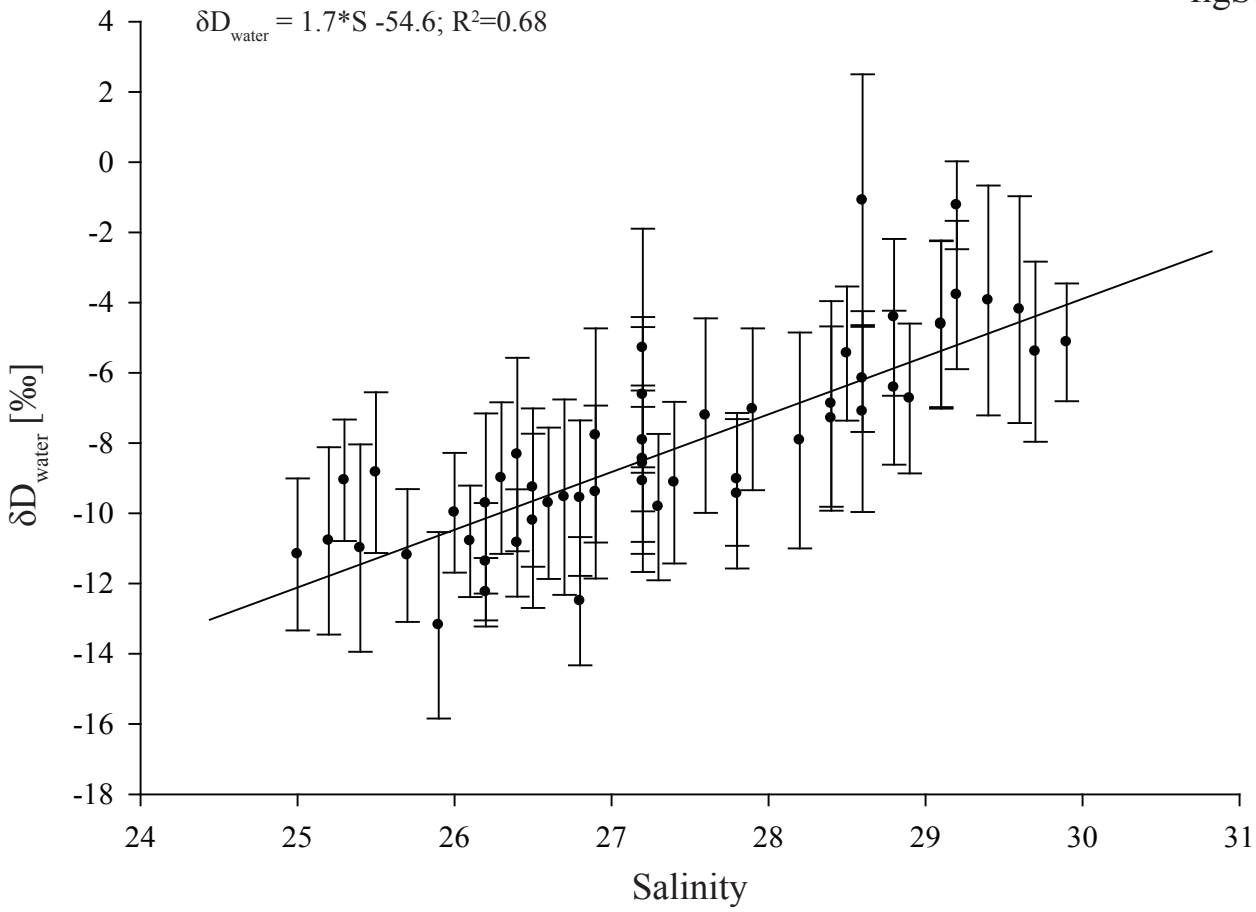
Gammaproteobacteria











Supplementary Data: Tables

Table S1: Chlorophyll *a* concentration measured between the 16/08/10 and the 15/12/11 in $\mu\text{g/L}$.

Date	c Chlorophyll <i>a</i> [$\mu\text{g/L}$]	Date	c Chlorophyll <i>a</i> [$\mu\text{g/L}$]
16/08/10	7.1	06/06/11	5.1
30/08/10	6.7	09/06/11	4.4
15/09/10	7.7	17/06/11	2.9
28/09/10	4.6	23/06/11	4.5
22/10/10	4.0	30/06/11	6.3
01/11/10	4.1	04/07/11	6.7
15/11/10	1.9	15/07/11	5.7
26/11/10	3.6	21/07/11	3.3
17/12/10	4.5	27/07/11	5.7
24/01/11	3.7	01/08/11	3.2
10/02/11	1.2	08/08/11	5.6
23/02/11	0.5	22/08/11	6.6
08/03/11	5.2	29/08/11	4.4
23/03/11	12.9	12/09/11	4.6
05/04/11	22.2	21/09/11	1.8
11/04/11	8.6	29/09/11	3.4
19/04/11	10.7	14/10/11	1.8
26/04/11	14.0	20/10/11	3.0
03/05/11	5.0	31/10/11	2.7
11/05/11	5.5	15/11/11	2.6
18/05/11	2.0	28/11/11	2.0
24/05/11	10.8	15/12/11	1.6
01/06/11	1.8		

Table S2: Phytoplankton diversity and abundance. Abundance measured in cells/L.

Dates	cells/L [$\times 10^6$]															Total
	cyanobacteria					Cryptophyta		Chlorophyta		Diatoms					Haptophyta	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
08/09/10	6	3														9
15/09/10			3													3
23/09/10						2										2
28/09/10		1						1								2
08/10/10								1								1
14/10/10			42													42
22/10/10								1		2						3
01/11/10		1														1
15/11/10								2								2
26/11/10								2	2							4
17/12/10			9						2							11
24/01/11			3	13					2							18
10/02/11								2								2
23/02/11			1													1
08/03/11										2						2
15/03/11										2						2
23/03/11								1			1					2
28/03/11										2	1					3
05/04/11											3					3
11/04/11						0.5										0.5
19/04/11						1				2					7	10
26/04/11												9			21	30
03/05/11												3			26	29
11/05/11													2		13	15
18/05/11														0.5		0.5
24/05/11										2	3					5
06/06/11								1		1						2
09/06/11							0.5	1								1.5
17/06/11															1	1
23/06/11															1	1
30/06/11															3	3
04/07/11		0.5														0.5
15/07/11		1														1
21/07/11											1					1
27/07/11	6															6
01/08/11	9									2						11
08/08/11										1					1	2
15/08/11															1	1
22/08/11															2	2
29/08/11						0.5										0.5
12/09/11					1											1
15/09/11	8															8.2
21/09/11							0.2									2
29/09/11						1				1						2
14/10/11						1		1								2
20/10/11															2	2
31/10/11								1								1
15/11/11		3														3
28/11/11								2								2
15/12/11								2		1						3

Cyanobacteria: A *Chroococcaceae*, B *Chlorococcales*, C *Cyanophyta*, D *Snowella*, E *Microcystis*; Cryptophyta: F *Hemiselmis*, G *Plagioselmis*; Chlorophyta: H *Prasinophyceae*, I Chlorophyta; Diatoms: J *Bacillariales*, K *Thalassiosiraceae*, L *Chaetoceros*, M *Pseudo-nitzschia delicatissima*, N *Cylindrotheca closterium*; Haptophyta: O *Phaeocystis globosa*

Table S3a: Phyla-level bacterial diversity and abundance in North Sea SPM based on the 16S rRNA gene amplicon sequencing. Diversity and abundance of Proteobacteria on class level. Percentage based on total bacteria reads including Chloroplast reads.

bacterial groups	% of total bacteria reads															
	28/09/2010	26/11	10/01/2011	08/03	23/03	05/04	19/04	03/05	18/05	17/06	30/06	15/07	22/08	06/09	21/09	28/10/2011
<i>Actinobacteria</i>	5.2	6.7	3.9	1.5	1.0	0.8	1.2	1.4	7.3	5.7	4.7	3.3	9.5	5.5	10.6	7.4
<i>Bacteroidetes</i>	20.8	16.7	16.9	15.3	18.8	29.8	33.8	31.8	35.5	29.3	32.3	26.7	23.1	22.9	17.8	17.3
<i>Cyanobacteria</i>	6.7	10.0	13.2	41.9	21.5	17.4	5.8	15.2	1.2	10.9	6.9	10.5	14.5	9.7	8.3	10.0
<i>Planctomycetes</i>	9.6	4.0	3.7	3.0	2.6	1.1	0.2	0.7	0.5	1.1	0.6	1.6	2.3	3.0	4.3	3.5
<i>α-Proteobacteria</i>	21.9	30.0	24.5	18.5	20.4	25.2	26.1	17.1	21.1	17.1	18.2	18.5	22.8	20.2	25.0	22.6
<i>β-Proteobacteria</i>	2.0	4.5	10.2	8.1	5.1	3.1	5.3	3.6	3.8	1.9	3.3	4.1	3.6	2.4	3.1	5.8
<i>δ-Proteobacteria</i>	3.0	4.3	3.7	4.9	3.8	1.4	0.8	2.5	1.8	4.9	1.3	4.0	2.7	5.4	5.6	5.7
<i>γ-Proteobacteria</i>	23.6	22.7	25.6	23.1	27.3	19.8	25.7	32.5	23.8	30.0	27.0	27.3	22.2	28.2	23.9	27.5
<i>Verrucomicrobia</i>	6.4	3.7	2.3	3.6	8.2	9.0	4.0	2.7	4.5	3.6	8.0	6.3	6.0	3.8	2.1	2.2

Table S3b: Order-level bacterial diversity and abundance in North Sea SPM based on the 16S rRNA gene amplicon sequencing. Percentage based on total bacteria reads excluding Chloroplast reads.

bacterial groups	% of total bacteria reads															
	28/09/ 2010	26/11	10/01/ 2011	08/03	23/03	05/04	19/04	03/05	18/05	17/06	30/06	15/07	22/08	06/09	21/09	28/10/ 2011
<i>Acidimicrobiales</i>	1.7	3.4	1.1	1.1	0.8	0.2	0.3	0.5	1.2	3.3	2.4	1.4	4.7	4.6	10.8	6.7
<i>Micrococcales</i>	3.2	1.7	1.1	0.2	0.1	0.6	0.8	1.1	6.1	2.6	2.4	2.0	5.8	1.2	0.3	0.2
<i>Flavobacteriales</i>	16.2	13.2	10.6	16.8	14.7	27.9	29.7	30.8	28.6	25.3	27.8	22.1	21.0	17.3	14.2	13.4
<i>Sphingobacteriales</i>	3.4	2.7	4.6	4.6	4.5	3.9	3.6	3.3	3.2	4.1	3.8	3.1	3.5	2.7	2.7	2.9
<i>Pirellulales</i>	8.1	2.9	2.9	3.1	2.6	0.6	0.1	0.3	0.1	0.3	0.4	1.0	1.8	2.1	3.4	2.7
<i>Rhodobacterales</i>	8.2	12.4	9.7	9.2	8.4	5.6	6.5	5.9	9.1	11.2	9.1	5.8	9.1	10.0	11.6	6.4
<i>Rickettsiales</i>	8.4	12.2	12.0	6.1	8.7	16.8	15.5	7.0	5.5	2.6	3.2	6.0	7.6	5.6	7.5	9.9
<i>Methylophiales</i>	0.9	1.8	2.5	1.9	1.0	1.0	1.2	0.7	1.7	1.0	2.3	2.4	2.0	1.7	1.6	4.0
<i>Rhodocyclales</i>	0.9	2.1	6.5	5.1	3.7	2.1	3.9	2.5	1.3	0.4	0.7	1.4	1.1	0.5	0.1	0.9
<i>Alteromonadales</i>	10.7	9.3	13.2	11.8	12.7	8.8	11.6	17.0	9.7	17.3	13.1	14.1	10.0	12.0	8.9	11.1
<i>Oceanospirillales</i>	3.0	7.9	4.3	5.1	7.3	7.4	12.0	7.8	10.5	7.1	8.1	6.5	6.6	7.2	8.7	8.4
<i>Thiotrichales</i>	3.1	1.6	2.9	1.6	2.4	1.2	0.4	3.8	1.6	1.7	3.2	2.6	3.1	3.4	1.4	2.5
<i>Puniceococcales</i>	0.6	1.0	0.3	1.9	5.4	8.5	3.4	1.3	0.9	0.4	5.6	2.6	3.5	1.4	0.9	0.7
<i>Verrucomicrobiales</i>	5.1	1.0	1.1	2.9	4.5	2.3	0.7	1.7	2.3	3.2	2.8	3.7	3.3	1.3	0.8	1.0

Actinobacteria: Acidimicrobiales, Micrococcales; Bacteroidetes: Flavobacteriales, Sphingobacteriales; Planctomycetes: Pirellulales; α -Proteobacteria: Rhodobacterales, Rickettsiales; β -Proteobacteria: Methylophiales, Rhodocyclales; γ -Proteobacteria: Alteromonadales, Oceanospirillales, Thiotrichales; Verrucomicrobia: Puniceococcales, Verrucomicrobiales

Table S4: Fatty acid abundance in North Sea water samples.

Date	Fatty acid abundance [%]					
	C14:0	C16:1*	C16:0	C18:x	C18:0	C20:5 PUFA
16/08/10	14	23	36	16	6	5
30/08/10	17	26	29	15	6	7
15/09/10	19	27	32	14	5	4
28/09/10	14	24	29	18	9	7
15/11/10	13	17	32	23	13	3
26/11/10	13	20	31	21	13	2
10/12/10	12	13	35	28	11	1
17/12/10	11	30	28	26	4	0
10/01/11	9	27	32	23	8	0
24/01/11	7	23	29	30	7	4
17/02/11	8	27	31	24	9	0
08/03/11	11	35	24	16	3	11
23/03/11	13	33	21	17	5	12
05/04/11	10	34	26	13	4	13
19/04/11	13	35	25	11	2	14
03/05/11	17	23	23	22	2	12
18/05/11	17	28	29	12	6	9
17/06/11	21	21	35	9	10	4
30/06/11	27	20	26	14	5	8
15/07/11	21	25	28	9	7	10
27/07/11	16	25	33	11	10	5
08/08/11	14	25	26	10	7	18
22/08/11	21	15	31	17	8	7
06/09/11	14	20	32	10	18	6
21/09/11	13	16	38	20	10	3
11/10/11	16	22	37	13	11	0
28/10/11	12	21	32	22	9	5
15/11/11	12	25	31	17	8	6
28/11/11	15	26	32	15	7	5
16/12/11	8	27	30	19	9	6

*n*C16:1*: double bond at the ω 7 position

Table S5: δD values of fatty acids.

Date	$\delta D_{\text{fatty acid}}$ [‰]				
	C14:0	C16:0	C16:1*	C18:0	C20:5 PUFA
16/08/10	-219	-201	-201	-185	-191
30/08/10	-222	-202	-189	-186	-199
15/09/10	-216	-206	-197	-186	-180
28/09/10	-219	-198	-192	-197	-207
15/11/10	-213	-203	-182	-200	N.D.
26/11/10	-226	-202	-188	-203	N.D.
10/12/10	-225	-188	-191	-202	N.D.
17/12/10	-232	-193	-194	-188	N.D.
10/01/11	-221	-200	-186	-204	N.D.
24/01/11	-212	-191	-195	-192	-209
17/02/11	-223	-208	-195	-206	N.D.
08/03/11	-226	-214	-205	-182	-235
23/03/11	-241	-216	-205	-190	-241
05/04/11	-223	-210	-209	-212	-223
19/04/11	-235	-224	-221	N.D.	-240
03/05/11	-238	-225	-214	-212	-236
18/05/11	-219	-205	-198	-178	-214
17/06/11	-225	-211	-196	-190	N.D.
30/06/11	-225	-210	-202	-175	-213
15/07/11	-204	-195	-188	-181	-217
27/07/11	-220	-200	-203	-180	-201
08/08/11	-222	-202	-201	-180	-234
22/08/11	-231	-202	-189	-190	-202
06/09/11	-224	-217	-221	-216	-218
21/09/11	-218	-204	-185	-194	N.D.
11/10/11	-213	-191	-183	-188	-226
28/10/11	-217	-187	-181	-184	-207
15/11/11	-212	-198	-191	-184	-221
28/11/11	-217	-193	-190	-180	-197
16/12/11	-198	-179	-174	-188	N.D.

*n*C16:1*: double bond at the ω 7 position

Table S6: Fatty acid profiles of the bacterio- and phytoplankton observed via 16S rRNA gene amplicon sequencing and microscopy.

Organism	Fatty acid profile	Literature
<i>Acidimicrobiales</i>	OCS155: uncultured <i>Microthrixaceae</i> : fatty acid profile not determined	
<i>Micrococcales</i>	<i>Microbacteriaceae</i> : mainly <i>ai</i> C15:0, <i>i</i> C16:0, <i>a</i> C17:0	(Evtushenko and Takeuchi, 2006)
<i>Flavobacteriales</i>	<i>Flavobacteriaceae</i> : mainly <i>i</i> C15:0, <i>ai</i> C15:0, C15:0; only traces of C16:0, C18:0, C14:0 <i>Cryomorphaceae</i> : mainly <i>i</i> C15:0, <i>i</i> C15:1 ω 10, C15:0; only traces of C16:0, C18:0, C14:0	(Van Trappen et al., 2004b; Khan et al., 2006; Heindl et al., 2008) (Bowman et al., 2003; O'Sullivan et al., 2005)
<i>Sphingobacteriales</i>	<i>Sphingobacteriaceae</i> : mainly <i>i</i> C15:0, <i>i</i> C17:0 3-OH, <i>i</i> C17:1 ω 9 and potentially C16:1 ω 7; minor amounts of C16:0 and C14:0 NS11-12: uncultured	(Gallego et al., 2006)
<i>Pirellulales</i>	<i>Pirellulaceae</i> : mainly C16:0, C18:1 ω 9; minor amounts of C14:0, C16:1 ω 7 and C18:0	(Kerger et al., 1988; Schlesner et al., 2004)
<i>Rhodobacterales</i>	<i>Rhodobacteraceae</i> : mainly C18:1 ω 7, C16:0, C16:1 ω 7, C18:0	(Yoon et al., 2007a; Venkata Ramana et al., 2009; Jung et al., 2010; Park and Yoon, 2014)
<i>Rickettsiales</i>	SAR11 cluster: fatty acid profile not determined	
<i>Methylophiales</i>	<i>Methylophilaceae</i> : mainly C16:0 and C16:1 ω 7; traces of C18:0	(Kalyuzhnaya et al., 2006; Kalyuzhnaya et al., 2012)
<i>Rhodocyclales</i>	<i>Rhodocyclaceae</i> : mainly C16:0, C16:1 <i>cis</i> -9, C18:1; only traces of C14:0 and C18:0	(Reinhold-Hurek et al., 1993; Anders et al., 1995)

<i>Alteromonadales</i>	<i>Alteromonadaceae</i> : mainly C18:1 ω 7, C16:0, C16:1 ω 7; only traces of C14:0 and C18:0 SAR92 clade: fatty acid profile not determined OM60 clade: mainly C16:0, C16:1 ω 7, C16:1 ω 6, C18:1 ω 7; only traces of C14:0 and C18:0	(Bowman et al., 1998; Van Trappen et al., 2004a; Tang et al., 2008; Lee et al., 2012; Teramoto and Nishijima, 2014) (Spring et al., 2009; Spring et al., 2013)
<i>Oceanospirillales</i>	<i>Halomonadaceae</i> : mainly C16:0, C18:1 ω 7; minor amounts of C14:0, C16:1 ω 7; traces of C18:0	(Sánchez-Porro et al., 2009; Long et al., 2013)
<i>Thiotrichales</i>	<i>Piscirickettsiaceae</i> : mainly C16:0, C16:1 ω 7; minor amounts of C14:0; traces of C18:0 <i>Thiotrichaceae</i> : mainly C18:1 ω 7, C16:1 ω 7, C16:0; minor amounts of C14:0, C18:0	(Doronina et al., 2003; Kim et al., 2007; Antony et al., 2012) (Aruga et al., 2002)
<i>Puniceicoccales</i>	<i>Coraliomargarita</i> : mainly C14:0, C18:1 ω 9, C18:0	(Yoon et al., 2007b)
<i>Verrucomicrobiales</i>	<i>Verrucomicrobiaceae</i> : mainly C16:0, some also C14:0 and C16:1 ω 7	(Yoon et al., 2008)
<i>Chlorophyta</i>	<i>Mamiellales</i> : mainly C16:0, C16:1 ω 7, C18:1 ω 7, C18:1 ω 9; only traces of C14:0 and C18:0	(Martínez-Fernández et al., 2006; Vaezi et al., 2013)
<i>Stramenopiles</i> (diatoms)	<i>Thalassiosira</i> : mainly C14:0, C16:0, C16:1 ω 7; only minor amounts of C18:0 <i>Chaetoceros</i> : mainly C14:0, C16:0, C16:1 ω 7, C20:5; only minor amounts of C18:0	(Viso and Marty, 1993) (Viso and Marty, 1993; Zhukova and Aizdaicher, 1995)

<i>Haptophyta</i>	<i>Phaeocystis</i> : mainly C14:0, (Al-Hasan et al., 1990; C16:0, C18:1 ω 9; minor Nichols et al., 1991; amounts of C16:1 ω 7, C18:0 Hamm and Rousseau, and C20:5 PUFA 2003)
<i>Cryptophyta</i>	<i>Chroomonas</i> : mainly C16:0, (Viso and Marty, 1993; C18:1 ω 9, C20:5 PUFA; only Zhukova and minor amount of C14:0, Aizdaicher, 1995) C16:1 ω 7 and C18:0

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