Supplementary Material

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Supplementary Table S1. Debris items from Washington and Oregon with Stylonematophycean crusts

Collection date	Item	Size (cm)	Collection site	Coordinates	Condition[a] and culture No.	Sequence or specimen No. with gene and GenBank accession No.
Glass debris with *Viator vitreocola*						
Mar 2013	Ball fishing float	10	LPSP, Long Beach, WA	46°34.2′ N, 124°3.8′ W	Dried, purple decay	Not sequenced
Mar 2, 2016	Ball fishing float	10	LPSP, Long Beach, WA	46°34.2′ N, 124°3.8′ W	Preserved & dried	H330: *rbc*L, MK775235
Apr 2, 2017	Vodka bottle	8 × 28	LPSP, Long Beach, WA	46°34.2′ N, 124°3.8′ W	Alive on damp paper	H78: *psb*A, MK775211; *rbc*L, MK775231; SSU, MK775217 H80: *psb*A, MK775212; *rbc*L, MK775232; SSU, MK775218
Mar 25, 2018	1 fluor. tube, Phillips; TYPE	2.7 × 59	ORMR, Otter Crest, OR	44°44.9′ N, 124°3.8′ W	Alive in media; cultures 4881 (1-10)	Type collection H267, H268, H269; Type cultures H297-H301: *psb*A, MK775210; *rbc*L, MK775230; SSU, MK775216
May 16, 2018	4 fluor. tubes	2.7 × 59 (2), 3 × 122 (2)	LPSP, Long Beach, WA	46°34.2′ N, 124°3.8′ W	Dried	H293, H294, H295, H29: *psb*A, MK775213; *rbc*L, MK775233; SSU, MK775219
Nov 6, 2018	1 fluor. tube	2.7 × 59	LPSP, Long Beach, WA	46°21′ N, 124°3.3′ W	Died	H329, H331: *rbc*L, MK775234
Dec 19, 2018	500-watt bulb	11 × 24	Long Beach, WA	46°21′ N, 124°3.3′ W	Alive; temp	WA_LB 19 Dec 2018: *rbc*L, MK809517
Dec 21, 2018	White glass liquor bottle	7.5 × 20	LPSP, Long Beach, WA	46°21′ N, 124°3.3′ W	Alive; temp	WA_LB 21 Dec 2018: *rbc*L, MK809518
Dec 24, 2018	1 fluor. tube	2.7 × 59, fragment	Long Beach, WA	46°21′ N, 124°3.3′ W	Alive	WA_LB 24 Dec 2018: *rbc*L, MK809519
Dec 28, 2018	Halide bulb	10.5 × 25	Nye Beach, OR	44°38.3′ N, 124°3.8′ W	Alive; temp	WA_NB 28 Dec 2018: *rbc*L, MK809520

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Supplementary Table S1. Continued

Collection date	Item	Size (cm)	Collection site	Coordinates	Condition[a] and culture No.	Sequence or specimen No. with gene and GenBank accession No.
Plastic debris with *Tsunamia transpacifica*						
Mar 2, 2015	White tray fragment	Not measured	Long Beach, WA	46°21′ N, 124°3.3′ W	Dried 130	130: SSU, MK775215
Nov 5, 2015	Plastic bottle - original	9.5 × 28.5	LPSP, Long Beach, WA	46°34.2′ N, 124°3.8′ W	Alive in media; cultures 4874	416, type collection: *rbc*L, MK808020 4874, type culture: *rbc*L, KX787936.2
Dec 26, 2015	Pink float fragment	30 cm diameter	Nye Beach, OR	44°38.3′ N, 124°3.8′ W	Dried	430: *psb*A, MK775209; *rbc*L, MK775224
Dec 26, 2015	White box fragments	12-24	Nye Beach, OR	44°38.3′ N, 124°3.8′ W	Dried	432[b]: *rbc*L, MK775228
Jan 9, 2016	White tray fragments	12-24	Dumpster, Long Beach, WA	46°21′ N, 124°3.3′ W	Dried	433: *psb*A, MK775208
Mar 18, 2016	Assorted fragments	12-24	Lost Creek, OR	44°32.7′ N 124°4.4′ W	Dried	612[b]- 615[b]: *psb*A, MK775206; *rbc*L, MK775222
Mar 18, 2016	White float fragment	Not measured	Nye Beach, OR	44°38.3′ N, 124°3.8′ W	Dried	610[b]: *rbc*L, MK775229
Mar 24, 2016	White jug	33 cm tall	Quail Street, OR	44°28.9′ N 124°5.1′ W	Dried	622[b]: *rbc*L, MK775227
Mar 26, 2016	Blue basket fragment	24	Yaquina Bay Light, OR	44°37.3′ N, 124°3.8′ W	Dried	616[b]: *psb*A, MK775207; *rbc*L, MK775223; 618[b], H19
Mar 2-3, 2017	Black basket + assorted	Not measured	Oysterville, Long Beach, WA	46°33′ N, 124°1.5′ W	Alive on damp paper; cultures 4879 (1-2), 4880 (1-15)	4879: *rbc*L, MK775221 4880: 15 isolates, *psb*A, MK775205; *rbc*L, MK775220; SSU, MK775214
Mar 2-3, 2017	Assorted plastic	12-24	Quail Street, OR	44°28.9′ N 124°5.1′ W	Dried on paper	H81: *rbc*L, MK775226
Mar 13, 2017	Assorted fragments	Not measured	Long Beach, WA	46°21′ N, 124°3.3′ W	Dried	H79: *rbc*L, MK775231
Mar 26, 2016	White tray fragment	Not measured	Nye Beach, OR	44°38.3′ N, 124°3.8′ W	Dried	621, H22

WA, Washington; LPSP, Leadbetter Point State Park, Long Beach Peninsula; OR, Oregon; ORMR, Otter Rock Marine Reserve; fluor., fluorescent; temp, temporary culture.

[a]Condition on arrival in the laboratory.

[b]*rbc*L sp. 2 (West et al. 2016) = *Tsunamia transpacifica* as documented in this paper.

Supplementary Table S2. Summary of molecular data and models used for tree reconstructions

Gene	Length of alignment (bp)[a]	BIC model selected[b]	ML likelihood[c]
*rbc*L	1,467		-11,478.7173
1st codon position	-	GTR+F+I+G4	-
2nd codon position	-	SYM+I+G4	-
3rd codon position	-	TVM+F+I+G4	-
*psb*A	1,083		-4,114.7890
1st codon position	-	TN+F+I+G4	-
2nd codon position	-	K3P+I+G4	-
3rd codon position	-	TVM+F+I+G4	-
SSU	805	TNe+I+G4	-4,172.1738
3-gene supermatrix	3,355	-	-21,230.5070
*rbc*L			
1st codon position	-	GTR+F+I+G4	-
2nd codon position	-	GTR+F+I+G4	-
3rd codon position	-	TVM+F+I+G4	-
*psb*A			
1st codon position	-	TN+F+I+G4	-
2nd codon position	-	K3P+I+G4	-
3rd codon position	-	TVM+F+G4	-
SSU	-	TIM2e+I+G4	-

BIC, Bayesian information criterion; SSU, small ribosomal RNA.
[a]Total alignment length in nucleotides (bp).
[b]Best fit models determined by IQtree (BIC) for each individual gene and partition in the alignment, plus the concatenated supermatirx.
[c]Maximum-likelihood (ML) score (-log Ln) shown.

Supplementary Table S3. Pairwise comparison of *rbc*L genes in *Tsunami*a and *Viator* species and variants investigated during this study

	Species name	Identity	Source	Total (bp)	Pairwise identities		
					Proportion (bp)	Difference (bp)	Similarity (%)
1A	*Tsunamia transpacifica*	Holotype culture (4874), KX787936.2	Long Beach bottle; Nov 5, 2015	1,204	646 / 756	107-110	85.4-85.8
	Viator vitreocola	Long Beach tube 3, MK775233	Long Beach tubes 1-4; May 16, 2018	883			
1B	*Tsunamia transpacifica*	Holotype culture (4874), KX787936.2	Long Beach bottle; Nov 5, 2015	1,204	752 / 755	0-3	99.6-100
	Tsunamia transpacifica	Original bottle (416, Type collection), MK808020	Long Beach bottle; Nov 5, 2015	896			
2A	*Tsunamia transpacifica*	Original bottle (416, Type collection), MK808020	Long Beach bottle; Nov 5, 2015	896	892 / 896	0-4	99.6-100
	*rbc*L sp. 2 -- true	Isolate 622, MK775227	Quail Street jug; Mar 24, 2016	1,135			
2B	*Tsunamia transpacifica*	Original bottle (416, Type collection), MK808020	Long Beach bottle; Nov 5, 2015	896	894 / 896	0-2	99.8-100
	*rbc*L sp. 2 -- true	Isolate 610, MK775229	Nye Beach float; Mar 18, 2016	1,451			
3A	*Viator vitreocola*	Original tube (Type collection), MK775230	Otter Crest tube; Mar 25, 2018	893	883 / 883	0	100
	Viator vitreocola	Long Beach tube 3, MK775233	Long Beach tubes 1-4; May 16, 2018	883			
3B	*Viator vitreocola*	Long Beach tube 3, MK775233	Long Beach tubes 1-4; May 16, 2018	893	743 / 756	13	98.3
	Uncultured *Viator* sp.	≠ Uncultured Stylonematales, KX787938.2	Unknown	1,014			

Supplementary Table S4. Characteristics of *Tsunamia transpacifica* and the phases of *Viator vitreocola* gen. et sp. nov.

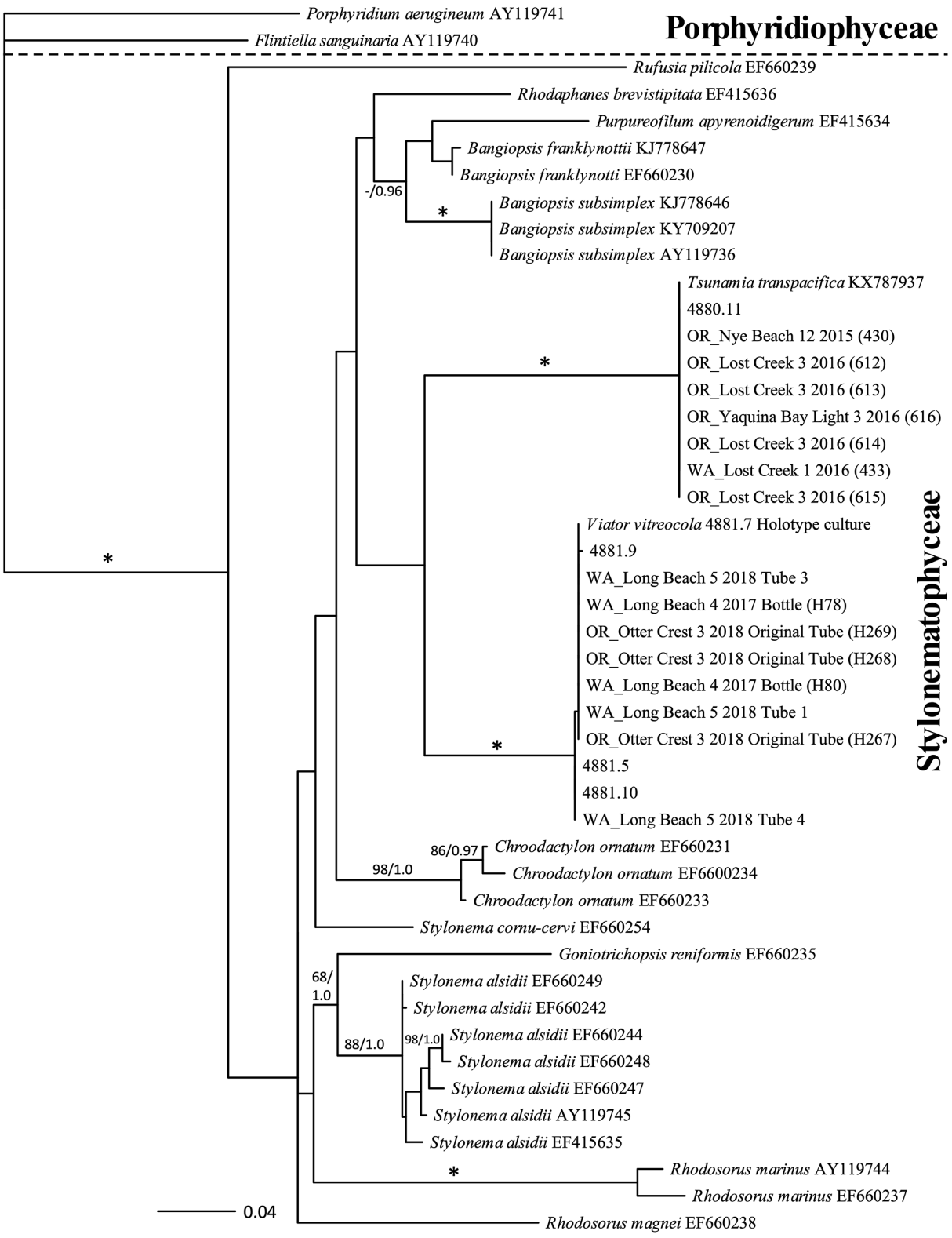
Characteristic	*Tsunamia transpacifica*[a]	*Viator vitreocola*	
		Young turf phase	Mature crust phase
Substrata	HDPE plastic debris >12 cm wide	Glass debris items	Glass debris items
Colony morphology	Irregular palmelloid colonies; co-inhabitants common: hydroids, diatoms, *Calothrix*, *Ulvella*, and young *Lepas anatifera*	Loose patches of turf; minimal co-inhabitants: diatoms and filamentous bacteria	Coherent crustose patches; minimal co-inhabitants: diatoms, rare hydroids and young *Lepas anatifera*
Thickness (µm)	Up to 500	300-500	370
Thallus anatomy	Mucilaginous colony containing single cells, small cell clusters, and short filaments of nearly equal diameter	Turf colony of small tightly appressed basal cells supporting a lawn of loose erect filaments that increase in diameter until just below their apices–uniseriate becoming bi to multiseriate	Coherent crustose colony of 3 layers: tightly appressed elliptical to elongate basal cells; loosely branched erect filaments in a mucilaginous matrix; free surface filaments
Thickness (µm)	Up to 500	300-500	370
Cell diameter and shape	Cells and short filaments (5) 8-10 (13) µm; spherical, ovate, elongate, short cylindrical	Spherical unicells 8-12 µm, spherical-ovoid basal cells 4-7 µm, and cylin-drical erect filaments 4-15 µm	Thick-walled basal cells 5 µm; perithallial cells 5-10 µm and surface filaments 4-12 µm; ovoid, elongate, or irregular
Cell cytology	Central nucleus and a single highly lobed parietal plastid; no pyrenoid	Central nucleus and a single highly lobed parietal plastid; no pyrenoid	Central nucleus and a single highly lobed parietal plastid; no pyrenoid
Cell division	Random	Diffuse	Basal, intercalary, diffuse
Reproduction	Individual cells released from gel as spores	Cells released from erect filaments as spores	Cells released from free surface filaments as spores
Spore size (µm)	9-12	8-12 (15)	8-12
Cultured morphology	Dense pulvinate crusts consisting of highly branched radiating filaments	Branched basal system of small cells with erect uniseriate filaments that become multiseriate	Not observed
Cultured reproduction	Palmelloid colony releases whole cells as spores; cultured filaments produce spores via oblique and longitudinal divisions	Whole cells released as spores from erect filaments; giant cells develop basally producing internal autospores	Not observed
Holotype *rbc*L	KX787936.2	MK775230	-
Holotype *psb*A	KX787937	MK775210	-
Holotype SSU	KX787935	MK775216	-

HDPE, high-density-polyethylene.

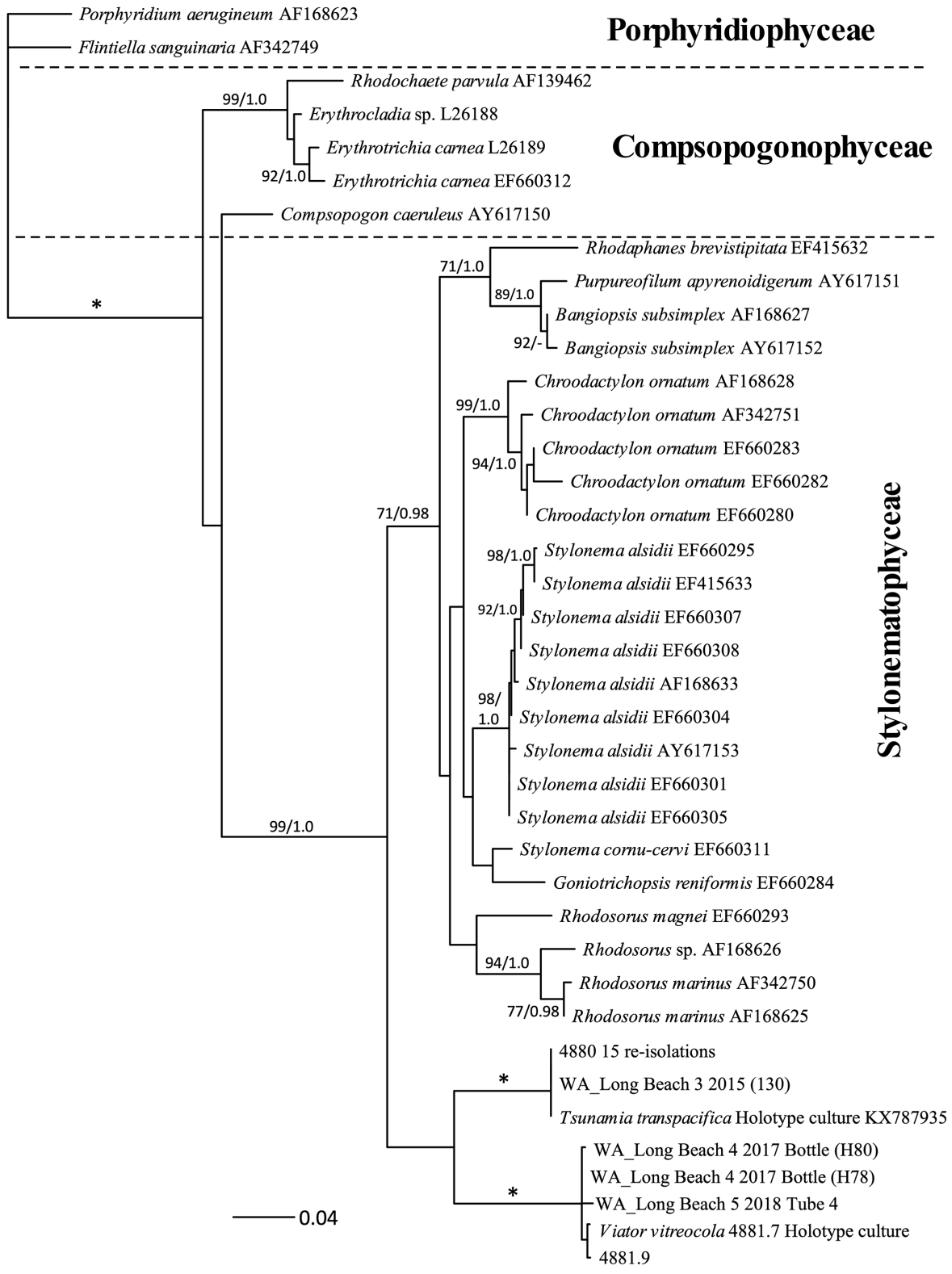
[a]*Tsunamia transpacifica* includes *rbc*L sp. 2 (West et al. 2016), as indicated in this paper.

REFERENCE

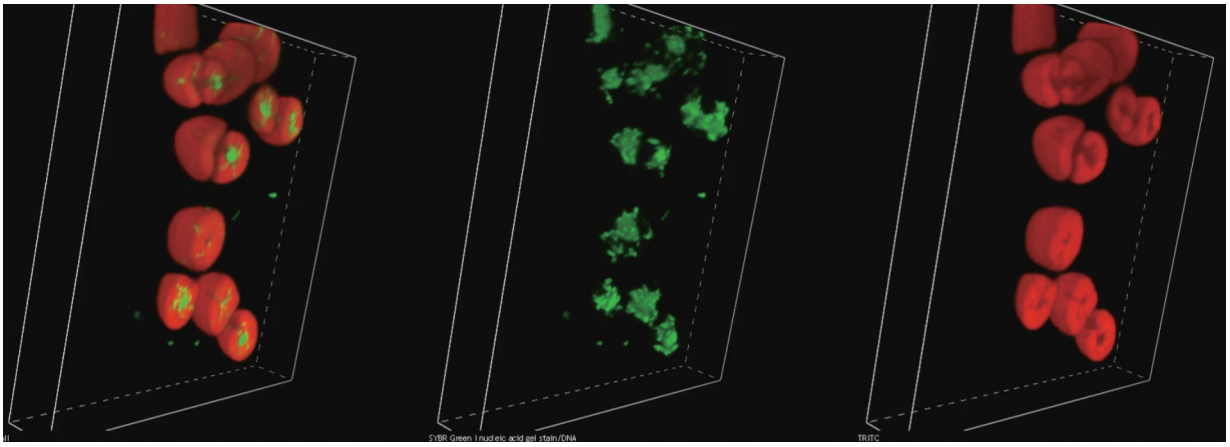
West, J. A., Hansen, G. I., Hanyuda, T. & Zuccarello, G. C. 2016. Flora of drift plastics: a new red algal genus, *Tsunamia transpacifica* (Stylonematophyceae) from Japanese tsunami debris in the northeast Pacific Ocean. Algae 31:289-301.



Supplementary Fig. S1. Maximum-likelihood (ML) phylogenetic topology of the *psb*A sequence data of various Porphyridiophyceae, Compsopogonophyceae and Stylonematophyceae. Both *Viator vitreocola* gen. et sp. nov. and *Tsumania transpacifica* are fully supported (*) by both ML bootstrap values (%) and Bayesian posterior probabilities. The sister relationship of these two genera is not supported. Bootstrap values / posterior probabilities are on branches. Values below 50% ML bootstrap and 0.9 / posterior probabilities not shown.



Supplementary Fig. S2. Maximum-likelihood (ML) phylogenetic topology of the SSU sequence data from various Porphyridiophyceae, Compsopogonophyceae and Stylonematophyceae. Both *Viator vitreocola* gen. et sp. nov. and *Tsumania transpacifica* are fully supported (*) by both ML bootstrap values (%) and Bayesian posterior probabilities. The sister relationship of these two genera is not supported. Bootstrap values / posterior probabilities on branches. Values below 50% ML bootstrap and 0.9 / posterior probabilities not shown.



Supplementary Video S1. SYBR Green DNA stained *Viator* cells in 360° rotation. Left figure is SBYR Green staining of whole cells with plastid autofluorescence, central figure is the SYBR stain of nuclear, plastid and mitochondrial DNA, and right figure is only plastid autofluorescence.