Supplementary data S2. List of sequences used for the phylogenetic inference, using: coxI gene (Folmer region) in Fig. 2 and; DNA encoding region for 28S rRNA (fragment D3-D5) in Fig. 3. The (T) in specimens from sequences retrieved from GenBank, represents types i.e., the sequences belong to type specimens. In BOLD the accession numbers produced in this study.

Organism	Specimen	Reference	*cox*I	28S D3-D5
Aaptos aaptos	0M9I5547-O	Thacker *et al.* 2013		KC869496
Acanthodendrilla australis	0CDN7722-C	Thacker *et al.* 2013		KC869643
Acanthorhabdus fragilis	NIWA37658	Vargas 2015	LN850168	
Amphilectus fucorum	Mc5093	Morrow *et al.* 2012		HQ379294
Amphilectus ovulum	LAR-180909-7069, 7071	This study		**OM415579**
Amphilectus ovulum	LAR-180909-7078–7079	This study		**OM415580**
Amphilectus ovulum	LAR-180911-7144, 7148	This study		**OM415578**
Amphilectus ovulum	LAR-181211-8369, 8373–8374	This study		**OM415610**
Amphilectus ovulum	LAR-181211-8376–8378	This study		**OM415573**
Amphilectus ovulum	LAR-181214-8406, 8408, 8410	This study		**OM415614**
Amphilectus ovulum	LAR-181218-8442, 8444, 8447	This study		**OM415591**
Amphilectus ovulum	LAR-181218-8448, 8457, 8458–8459	This study		**OM415609**
Amphilectus ovulum	LAR-191001-PA010091, 0093	This study		**OM415612**
Amphilectus ovulum	P088-111101-1	This study	**OM436236**	
Axinella infundibuliformis	Mc4438	Morrow *et al.* 2011	HQ379410	HQ379263
Batzella aurantiaca	HIMB_UPDM-SPO37	Pons *et al.* 2017	KY565335	
Biemna variantia	LAR-191105-PB050364, 66, 69	This study		**OM415582**
Biemna variantia	Mc5405	Morrow *et al.* 2011		HQ379292
Callyspongia fallax	POR14314	Redmond *et al.* 2011	JN242192	JN178976
cf. *Pleraplysilla spinifera*	POR19510	Erpenbeck *et al.* 2012	JQ082793	
cf. *Pleraplysilla spinifera*	POR19533	Erpenbeck *et al.* 2012	JQ082794	
cf. *Spongosorites calcicola*	LAR-180930-7479–7480	This study		**OM415585**
Chondrilla nucula	BH13	Erpenbeck *et al.* 2007	EF519584	
Chondrilla nucula	S36	Erpenbeck *et al.* 2007	EF519595	
Chondrilla nucula	S9	Erpenbeck *et al.* 2007	EF519598	
Cladocroce burapha	HIMB_UPDM-SPO32	Pons *et al.* 2017	KY565331	
Clathria aramata	Mc4359	Morrow *et al.* 2013	KC869418	KC869437
Clathria barleei	Mc4347	Morrow *et al.* 2013	KC883682	HQ393897
Clathria barleei	P071-111011-1	This study	**OM436235**	
Clathria kylista	QM / G307278	Vargas 2013	HE611599	
Clathria toxitenuis	Po.25881	Idan 2018	KX866770	
Cliona delitrix	SI06x122	Thacker *et al.* 2013		KC869510
Coscinoderma matthewsi	0CDN8725-S	Thacker *et al.* 2013		KC869557
Crambe crambe	Po.25545	Idan *et al.* 2018	KX866761	
Crambe stellifera	LAR-191116-PB160445, 47–48	This study		**OM415624**
Crella elegans	MC7174	Morrow *et al.* 2013	KC876698	HQ393898
Crella incrustans	0CDN6837-Q	Thacker *et al.* 2013		KC869608
Crella rosea	Mc2418	Vargas 2013		HQ379299
Desmapsamma anchorata	040313-17	Direct submission to GenBank	KJ546367	
Desmapsamma anchorata	S7	Erpenbeck 2007	EF519628	
Desmapsamma anchorata	UCMP WC1660	Belinky *et al.* 2012	HE591461	
Dysidea etheria	USNM_1133737	Thacker *et al.* 2013		KC869555
Dysidea fragilis	0CDN9476-K	Thacker *et al.* 2013		KC869605
Dysidea fragilis	LAR-181209-8249, 8251–8252	This study		**OM415602**
Dysidea fragilis	LAR-191116-PB160436–37, 39	This study		**OM415583**
Dysidea frondosa	P02x152	Thacker *et al.* 2013		KC869598

Organism	Specimen	Reference	*cox*I	28S D3-D5
Dysidea sp. nov.	G02x177	Thacker *et al.* 2013		KC869550
Dysidea sp. nov.	P10x20	Thacker *et al.* 2013		KC869454
Eurypon cf. *major*	Mc5439	Morrow *et al.* 2011		HQ379270
Eurypon clavigerum	Mc4992	Morrow *et al.* 2011	HQ379413	HQ379272
Eurypon coronula	LAR-191029-PA290237–0239	This study	**OM436224**	**OM415590**
Eurypon sp.	Mc4999	Morrow *et al.* 2011		HQ379274
Euryspongia lobata	0CDN9529-R	Thacker *et al.* 2013		KC869651
Fasciospongia chondrodes	0CDN9263-C	Thacker *et al.* 2013		KC869610
Fibulia cribriporosa	NIWA35726	Vargas 2015	LN850184	
Fibulia maeandrina	NIWA29023	Vargas 2015	LN850185	
Halichondria attenuata	Mc4732	Morrow *et al.* 2011		HQ393900
Halichondria bowerbanki	Mc4003	Morrow *et al.* 2011		HQ379316
Halichondria panicea	BIOUG00807-F05	Direct submission to GenBank	MG422903	
Halichondria panicea	LAR-180911-7191, 7194	This study	**OM436248**	
Halichondria panicea	LAR-180925-7457, 7460, 7463	This study	**OM436249**	**OM415607**
Halichondria panicea	LAR-181204-8186–8188	This study	**OM436281**	**OM415649**
Halichondria panicea	LAR-181204-8189–8191	This study	**OM436228**	**OM415594**
Halichondria panicea	LAR-181209-8193, 8197–8198	This study		**OM415600**
Halichondria panicea	LAR-181209-8205, 8207–8208	This study	**OM436242**	**OM415603**
Halichondria panicea	Mc4070	Morrow *et al.* 2013	KC869423	HQ379317
Halichondria panicea	P016-230414-7	This study	**OM436217**	
Halichondria panicea	SB16A	Regueiras *et al.* 2019	KY492588	
Haliclona urceolus	LAR -180911-7177–7178	This study	**OM436227**	
Haliclona urceolus	LAR -180911-7179–7180	This study	**OM436225**	
Haliclona urceolus	LAR-180909-7123	This study	**OM436259**	
Haliclona urceolus	LAR-180909-7055, 7057	This study	**OM436240**	
Haliclona urceolus	LAR-180909-7062	This study	**OM436229**	
Haliclona urceolus	LAR-180911-7183–7184	This study	**OM436218**	
Haliclona urceolus	LAR-180909-7125–7126	This study	**OM436270**	
Haliclona cinerea	MCZ:IZ:135221	Riesgo *et al.* 2014	JX999087	
Haliclona cinerea	POR14138	Redmond *et al.* 2011	JN242198	
Haliclona oculata	LAR-181214-8417–8419	This study	**OM436232**	**OM415598**
Haliclona oculata	LAR-181214-8421–8422, 8425, 8427	This study	-------	**OM415642**
Haliclona oculata	Mc4065	Morrow *et al.* 2011	HQ379430	HQ379326
Haliclona oculata	POR14116	Redmond *et al.* 2011	JN242199	JN178975
Haliclona simulans	Mc3342	Redmond *et al.* 2011	JN242200	
Haliclona sp.	Mc3343	Redmond *et al.* 2011	JN242210	
Haliclona sp. 1	LAR-191102-PB020337–38	This study	**OM436271**	**OM415636**
Haliclona urceolus	LAR-180925-7453, 7455–7456	This study		**OM415626**
Haliclona urceolus	MIIG0223	Redmond *et al.* 2011	JN242207	
Haliclona urceolus	LAR-191102-PB020253–54	This study	**OM436231**	**OM415596**
Halicnemia verticillata	Mc5018	Morrow *et al.* 2011	HQ379414	HQ379276
Halisarca desqueyrouxae	N.A.	Direct submission to GenBank	KY564211	
Halisarca dujardinii	1039	Ereskovsky 2011	EU237483	
Halisarca dujardinii	1040	Ereskovsky 2011	HQ606143	
Halisarca dujardinii	BIOUG14665-G12	Direct submission to GenBank	MG421851	
Halisarca dujardinii	LAR-180909-7064, 7066	This study	**OM436274**	
Halisarca dujardinii	LAR-180909-7114, 7116	This study	**OM436238**	
Halisarca dujardinii	LAR-180925-7431–7432	This study	**OM436253**	**OM415611**
Halisarca dujardinii	LAR-181209-8199–8201	This study	**OM436243**	**OM415604**
Halisarca dujardinii	LAR-181209-8268, 8272–8273	This study	**OM436267**	**OM415634**

Organism	Specimen	Reference	*cox*I	28S D3-D5
Halisarca sp. "*hansghonsoni*"	P089-111026-1 T	This study	**OM436239**	
Halisarca harmelini	MNHN DJV128 T	Ereskovsky *et al.* 2011	HQ606142	
Hamigera hamigera	Mc7316	Direct submission to GenBank		KF018112
Hemimycale arabica	CEAB.POR.GEN.001	Uriz *et al.* 2017	KY002124	KY002181
Hooperia anfractuosa	QM G300723 T	Direct submission to Genbank	MK096538	
Hymdesmia pauperta	Mc5629	Direct submission to GenBank		KF018118
Hymedesmia aequata	LAR-180930-7510–7511, 7517	This study		**OM415630**
Hymedesmia aequata	LAR-180930-7503–7504	This study		**OM415646**
Hymedesmia dujardinii	LAR-191102-PB020302–03	This study		**OM415641**
Hymedesmia dujardinii	LAR-191102-PB020285, 87, 89	This study		**OM415622**
Hymedesmia dujardinii	LAR-191102-PB020269, 71–72	This study		**OM415619**
Hymedesmia dujardinii	LAR-191102-PB020339–!41	This study		**OM415575**
Hymedesmia dujardinii	LAR-191102-PB020344–45	This study		**OM415574**
Hymedesmia hibernica	LAR-180918-7208,7211, 7213	This study	**OM436264**	
Hymedesmia hibernica	LAR-180930-7519–7520, 7522	This study		**OM415623**
Hymedesmia hibernica	LAR-191029-PA290209, 0213	This study		**OM415640**
Hymedesmia hibernica	LAR-191029-PA290232, 0235	This study		**OM415581**
Hymedesmia hibernica	LAR-191102-PB020248–49	This study		**OM415627**
Hymedesmia hibernica	LAR-191110-PB100415, 17–18	This study		**OM415613**
Hymedesmia hibernica	LAR-191116-PB160441, 43–44	This study		-------
Hymedesmia hibernica	LAR-191102-PB020316, 18–19	This study		**OM415586**
Hymedesmia hibernica	LAR-181209-8233,8234, 8238	This study		**OM415643**
Hymedesmia hibernica	LAR-191105-PB050373	This study		**OM415616**
Hymedesmia hibernica	LAR-191116-PB160449–51	This study		**OM415639**
Hymedesmia hibernica	LAR-180930-7496, 7500	This study	**OM436279**	**OM415648**
Hymedesmia jecusculum	LAR-180918-7215, 7217	This study	**OM436251**	
Hymedesmia jecusculum	LAR-181209-8217, 8219, 8222	This study	**OM436265**	
Hymedesmia methanophila	UPSZTY 167252 T	Rubin-Blum 2017	KU659137	
Hymedesmia pansa	Mc5725	Morrow *et al.* 2011		KF018110
Hymedesmia primitiva	LAR-180911-7157, 7161	This study	**OM436275**	
Hymedesmia primitiva	LAR-180909-7108,7109	This study	**OM436245**	
Hymedesmia primitiva	LAR-180930-7513, 7523–7524	This study	**OM436256**	**OM415617**
Hymedesmia sp.	Mc4042	Direct submission to GenBank		HQ379302
Hymedesmia sp. 1	LAR-191110-PB100407–09	This study		**OM415620**
Hymedesmia sp. 2	LAR-180923-7380, 7383–7384	This study	**OM436219**	
Hymedesmia sp. 3	LAR-180918-7197–7198	This study	**OM436233**	
Hymedesmia sp. 4	LAR-191116-PB160433, 35	This study		**OM415632**
Hymeniacidon heliophila	0M9G1369-A	Thacker *et al.* 2013		KC869620
Hymeraphia breeni	Mc4693	Morrow *et al.* 2013	KC869421	HQ379277
Hymeraphia elongata	LAR-180424-4603	This study	**OM436273**	
Hymeraphia elongata	LAR-180911-7154–7155	This study	**OM436254**	
Hymeraphia elongata	LAR-181209-8302–8303, 8305	This study	**OM436250**	
Hymeraphia stellifera	LAR-180923-7373, 7375–7376	This study	**OM436255**	**OM415615**
Hymeraphia stellifera	Mc4669	Direct submission to GenBank		HQ379275
Hymeraphia stellifera	P101-111110-1	This study	**OM436237**	
Hyrtios altus	0CDN8728-V	Thacker *et al.* 2013		KC869646
Iophon hyndmani	Mc4844	Direct submission to GenBank		KF018107
Iophon methanophila	UPSZTY 167253 T	Rubin-Blum *et al.* 2017	KU659138	
Ircinia campana	USNM_1133838	Thacker *et al.* 2013		KC869531
Ircinia strobilina	USNM_1133750	Thacker *et al.* 2013		KC869580
Isodictya compressa	0CDN7386-N	Thacker *et al.* 2013		KC869546

Organism	Specimen	Reference	*cox*I	28S D3-D5
Isodictya erinacea	NIWA28961	Vargas 2015	LN850199	
Isodictya frondosa	0CDN7366-Q	Thacker *et al.* 2013		KC869563
Isodictya grandis	0CDN7390-R	Thacker *et al.* 2013		KC869522
Kirkpatrickia coulmani	MNA5413	Rossi *et al.* 2019	MK803205	
kirkpatrickia variolosa	NIWA29189	Vargas 2015	LN850201	
Leiosella ramosa	0CDN7765-Y	Thacker *et al.* 2013		KC869570
Lissodendoryx arenaria	0CDN7285-C	Thacker *et al.* 2013		KC869561
Lissodendoryx isodictyalis	K31	Erpenbeck *et al.* 2007	EF519638	
Lissodendoryx jenjonesae	Mc4281	Direct submission to GenBank		HQ379298
Lissodendoryx sp.	B5	Erpenbeck *et al.* 2007	EF519640	
Luffariella geometrica	0CDN9035-G	Thacker *et al.* 2013		KC869636
Monanchora arbuscula	SI06x202	Thacker *et al.* 2013		KC869447
Mycale macilenta	0CDN7203-O	Thacker *et al.* 2013		KC869541
Mycale macilenta	LAR-191029-PA290222, 0224	This study		**OM415625**
Mycale macilenta	Mc3618	Direct submission to GenBank		KC869436
Mycale rotalis	Mc5391	Morrow *et al.* 2011		HQ379296
Myxilla ancorata	Mc3306	Morrow *et al.* 2011		HQ379304
Myxilla cf. *rosacea*	Mc4681	Morrow *et al.* 2013		KC883683
Myxilla fimbriata	LAR-181209-8224, 8228	This study	**OM436266**	**OM415633**
Myxilla incrustans	LAR-180918-7239, 7244	This study		**OM415593**
Myxilla incrustans	LAR-180923-7358–7359	This study	**OM436244**	**OM415605**
Myxilla incrustans	LAR-181209-8242, 8244–8245	This study		**OM628825**
Myxilla incrustans	LAR-190106-8623–8624	This study		**OM415576**
Myxilla incrustans	LAR-191102-PB020312, 13, 14	This study	**OM436222**	**OM415587**
Myxilla incrustans	Mc5139	Direct submission to GenBank		KC869432
Myxilla mollis	NIWA29123	VARGAS 2013	LN850210	
Niphatidae sp. 1	LAR-190924-P9240059, 63	This study	**OM436284**	**OM415650**
Oscarella pearsei	N.A.	Ereskovsky *et al.* 2017	NC_035983	
Oscarella pearsei	N.A.	Direct submission to GenBank		EF654519
Pachymatisma johnstonia	Mc3504	Morrow *et al.* 2011		HQ379258
Paratimea camelus	RMNH Por. 9924 T	Morrow *et al.* 2019	MK096539	
Paratimea hoffmannae	Mc2018.3 T	Morrow *et al.* 2019	MK096540	
Paratimea lalori	Mc7732 T	Morrow *et al.* 2019	MK096541	
Paratimea loennbergi	LAR-180424-4606, 4608	This study	**OM436247**	
Paratimea loennbergi	LAR-191001-PA010099, 0101	This study	**OM628823**	
Paratimea loennbergi	LAR-191029-PA290226, 0231	This study	**OM436262**	**OM415629**
Paratimea loennbergi	Mc4323	Morrow *et al.* 2011	HQ379419	HQ379284
Paratimea mosambicensis	MNHN-IP-2015-1412 T	Morrow *et al.* 2019	MK096542	MK096547
Paratimea oxeata	S153	Morrow *et al.* 2019	MK096543	
Paratimea rosacea	MNHN-IP-2015-1236	Morrow *et al.* 2019		MK096548
Phorbas bihamiger	Mc4493	Morrow *et al.* 2013		KC869431
Phorbas dives	LAR-180828-7014, 7016	This study	**OM436258**	
Phorbas dives	Mc4517	Direct submission to GenBank		HQ379303
Phorbas fictitius	LAR-180424-4598, 4600	This study	**OM436280**	
Phorbas fictitius	LAR-191116-PB160423–25	This study	**OM436220**	**OM415577**
Phorbas fictitius	Mc5345	Direct submission to GenBank		KF018111
Phorbas punctatus	Mc5343	Morrow *et al.* 2013		KC869439
Plakina coerulea	MNRJ:19188	Direct submission to Genbank	KY421466	
Plakina sp. 2	BFRO2	Direct submission to Genbank		MT742288
Plakinastrella osculifera	130205NC10-01	Ruiz *et al.* 2017	KU674380	
Plakinastrella sp.	UCMPWC938	Belinky *et al.* 2012		AY561870

Organism	Specimen	Reference	*cox*I	28S D3-D5
Pleraplysilla spinifera	LAR-180923-7385, 7388, 7390–7391	This study		**OM415621**
Pleraplysilla spinifera	LAR-191001-PA010115–0117	This study		**OM415572**
Pleraplysilla spinifera	LAR-191102-PB020294–96	This study	**OM436226**	**OM415592**
Pleraplysilla spinifera	LAR-180911-7170, 7174–7176	This study	**OM436221**	
Plocamiancora arndti	P132-181017-2	This study		**ON113815**
Plocamiancora arndti	P132-181017-3	This study	**ON113815**	
Polimastia mamillaris	ZMBN 98078	Plotkin *et al.* 2017	HG423713	HG423771
Polimastia mamillaris	ZMBN 98083	Plotkin *et al.* 2017	LN606463	LN873462
Polymastia cf. *bartletti*	GNM 904:1	Plotkin *et al.* 2017	LN606467	HG423768
Polymastia boletiformis	LAR-180923-7349, 7352, 7355	This study		**OM415588**
Polymastia boletiformis	ZMBN 98047	Vargas 2013	HG423708	LN606521
Protosuberites denhartogi	MC5288	Melis 2016	KX601195	
Protosuberites denhartogi	ZMAPOR0980	MELIS 2016	KX601196	
Protosuberites sp.	LAR-180424-4583, 4584	This study	**OM436223**	
Protosuberites sp.	LAR-181204-8156, 8159–8160	This study	**OM628824**	**OM415645**
Pseudosuberites hyalinus	NIWA28894	Vargas 2013	LN850222	
Pseudosuberites nudus	NIWA28874	Vargas 2013	LN850223	
Ptilocaulis sp.	G306291	Direct submission to GenBank	JQ034587	
Quasillina bervis	ZMBN 98084	Plotkin *et al.* 2017	HG423718	HG423776
Raspaciona aculeata	Mc4037	Morrow *et al.* 2011		HQ379278
Raspailia aculeata	LAR-191102-PB020281, 82	This study		**OM415589**
Raspailia aculeata	LAR-191102-PB020290, 93	This study		**OM415584**
Raspailia hispida	Mc3597	Morrow *et al.* 2011	HQ379416	HQ379279
Spirastrella cunctatrix	Po.25510	IDAN 2018		KX688739
Spirastrella hartmani	USNM_1133727	Thacker *et al.* 2013		KC869504
Spongia pertusa	USNM_1133722	Thacker *et al.* 2013		KC869488
Spongionella cf. *pulchella*	POR18157	Erpenbeck *et al.* 2012	JQ082798	
Stelletta grubii	Mc5043	Morrow *et al.* 2011		HQ379255
Stelligera rigida	M24I	Regueiras *et al.* 2019	KY492523	
Stelligera rigida	Mc4357	Morrow *et al.* 2011	HQ379420	HQ379285
Stelligera stuposa	Mc4330	Morrow *et al.* 2011	HQ379421	HQ379286
Suberites dandelenae	NA	Samaai et al 2017	KY463455	
Suberites dandelenae	NA	SAMAAI *et al.* 2017	KY463456	
Suberites domuncula	MCZ:IZ:135211	Riesgo *et al.* 2014	JX999078	
Suberites domuncula	NA	Lukić-Bilela *et al.* 2007	AM690374	
Suberites ficus	LAR-180828-7037, 7039	This study	**OM436283**	
Suberites ficus	LAR-180828-7041, 7046	This study	**OM436246**	
Suberites ficus	LAR-180918-7260, 7263	This study	**OM436268**	
Suberites ficus	LAR-180930-7532–7533, 7537	This study	**OM436277**	
Suberites ficus	LAR-191102-PB020297–98	This study	**OM436234**	**OM415599**
Suberites ficus	LAR-191102-PB020326, 29	This study	**OM436278**	**OM415644**
Suberites ficus	Mc4322	Morrow *et al.* 2013	HQ379429	HQ379322
Suberites ficus	P055-140514-XX	This study	**OM436282**	
Suberites ficus	LAR-191029-PA290245–0246	This study	**OM436252**	**OM415608**
Suberites massa	Mc4528	Morrow *et al.* 2011		HQ379324
Suberites montalbidus	LAR-191102-PB020321, 23–24	This study	**OM436272**	**OM415638**
Suberites montalbidus	P066-120410-6	This study		**OM415606**
Suberites montalbidus	P066-120425-1	This study		**OM415635**
Suberites pagurorum	Mc4043	Morrow *et al.* 2013	KC869422	HQ379323
Suberites spermatozoon	P062-140504-1	This study	**OM436260**	
Suberites spermatozoon	P062-140504-3	This study	**OM436257**	**OM415618**

Organism	Specimen	Reference	*cox*I	28S D3-D5
Suberites virgultosus	LAR-180823-6899, 6901	This study	**OM436230**	
Suberites virgultosus	LAR-180909-7096, 7098	This study	**OM436269**	
Suberites virgultosus	LAR-180918-7311–7312, 7315	This study	**OM436261**	**OM415628**
Suberites virgultosus	LAR-181218-8437, 8440–8441	This study	**OM436263**	**OM436263**
Suberites virgultosus	LAR-190924-P9240009, 010	This study	**OM436276**	
Suberites virgultosus	P056-111012-3	This study		**OM415647**
Suberites virgultosus	P056-111013-1	This study	**OM436241**	**OM415601**
Suberites virgultosus	P066-111012-3	This study		**OM628826**
Suberites virgultosus	P066-120409-1	This study		**OM415637**
Suberites virgultosus	P066-120409-2	This study		**OM415597**
Tedania strongylostyla	0CDN7611-I	Thacker *et al.* 2013		KC869515
Tedania tubulifera	0CDN7289-I	Thacker *et al.* 2013		KC869548
Terpios aploos	0CDN3602-Y	Thacker *et al.* 2013		KC869465
Tethyspira spinosa	Mc4641	Morrow *et al.* 2011		HQ379282

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