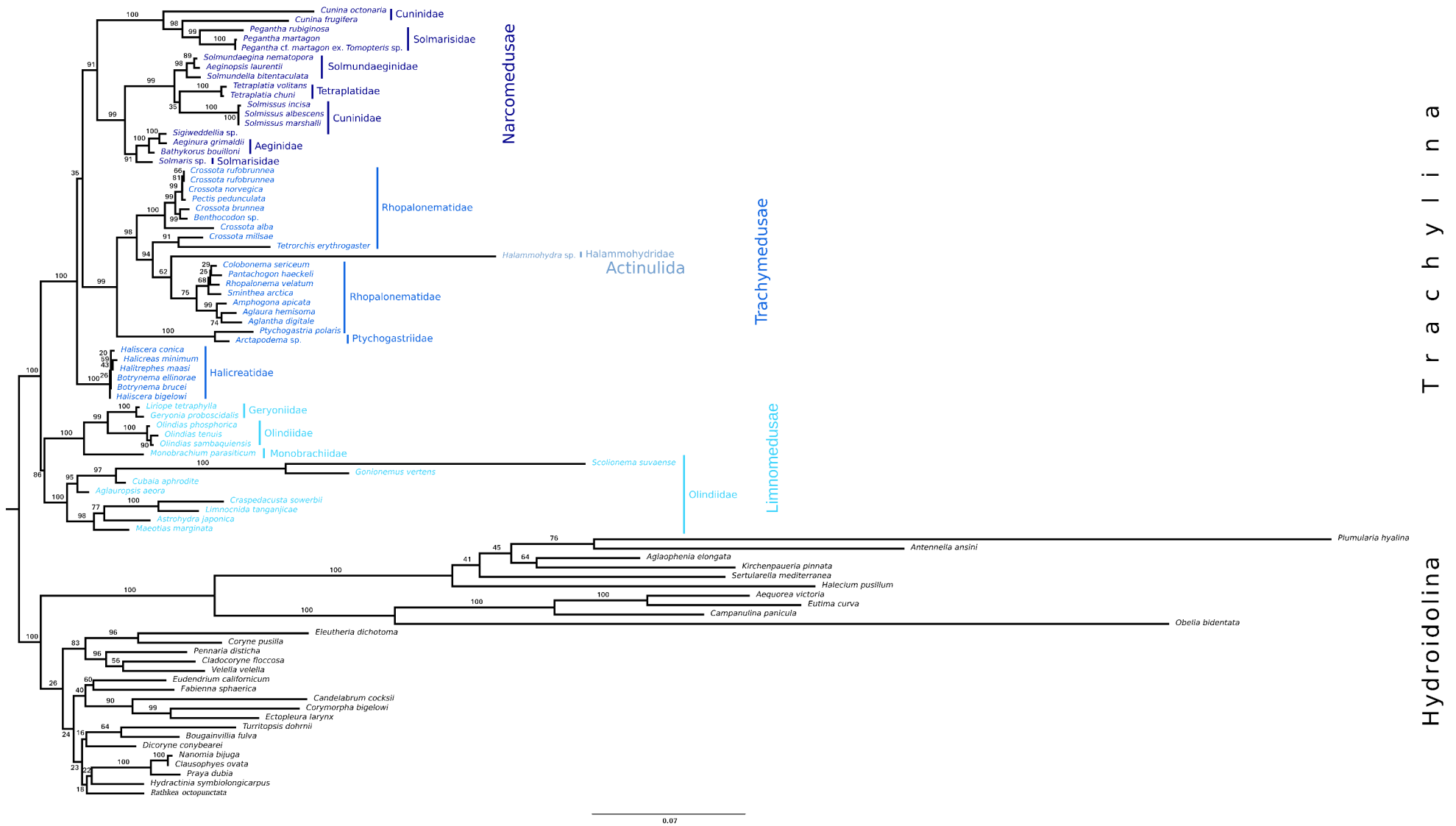


Trachylina

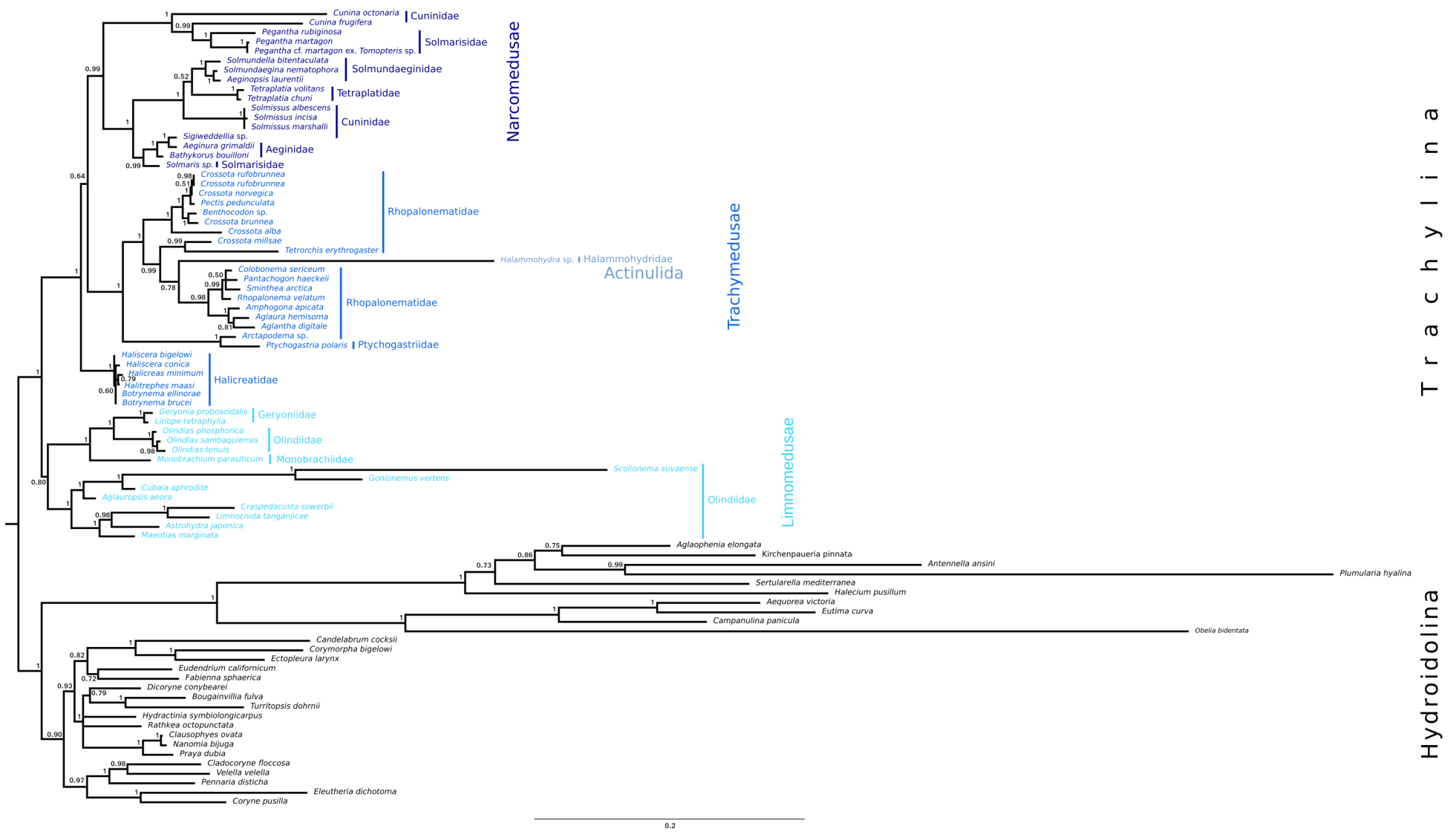
Hydroidolina

**Supplementary Fig. 1** Bayesian phylogeny inferred from the concatenated dataset of nuclear ribosomal 28S and 18S, and mitochondrial ribosomal 16S using the GTR+I+G model of nucleotide evolution. Posterior probabilities are shown on the nodes. Analysis was terminated when standard deviation of split frequencies fell below 0.01 after 235,000 iterations of the Markov Chain monte Carlo (MCMC) run.

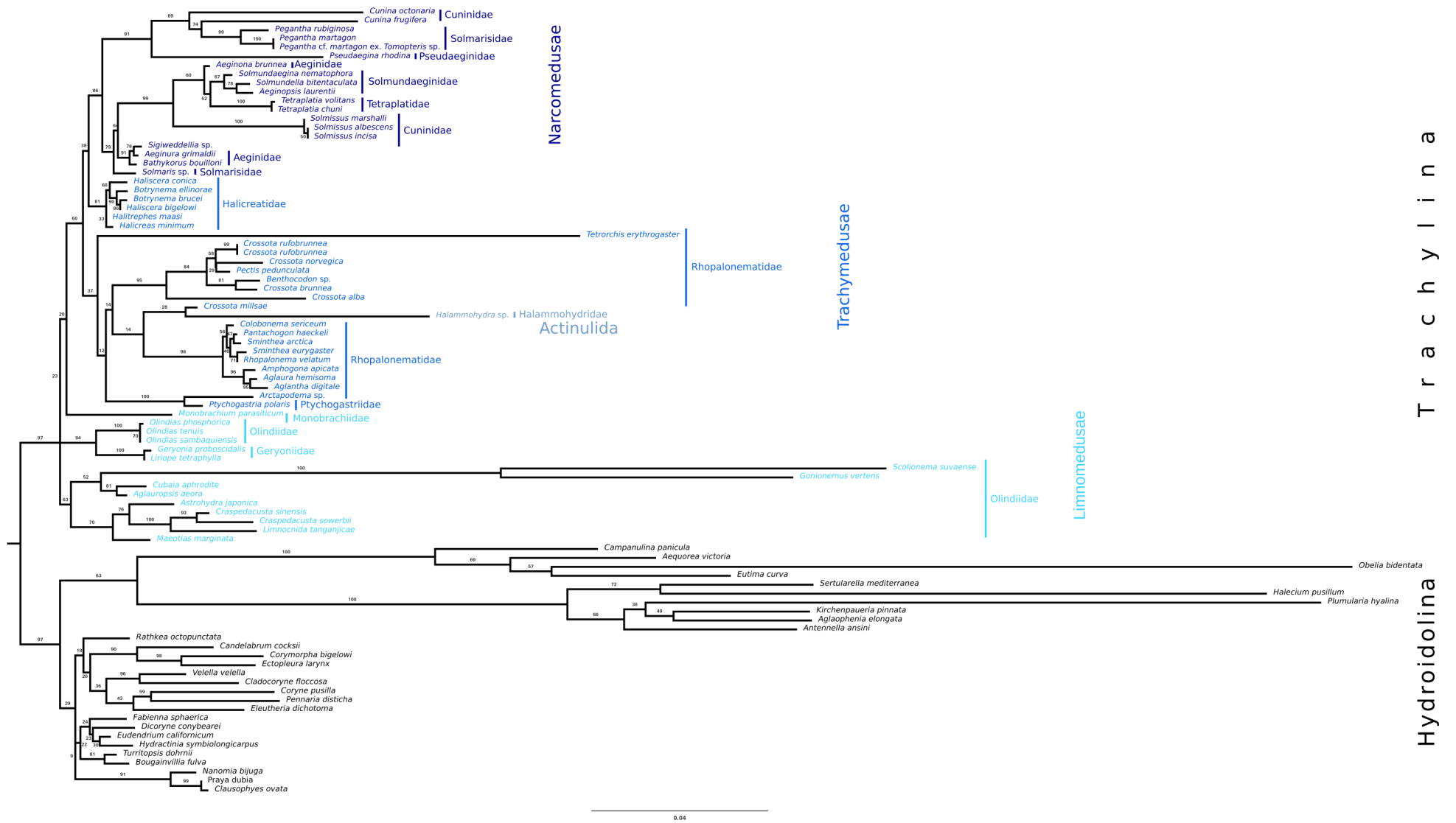


**Supplementary Fig. 2** Maximum likelihood phylogeny inferred from nuclear ribosomal 28S using the GTR+I+G model of nucleotide evolution.

Bootstrap support resulting from 1,000 non-parametric bootstrap replicates are shown in percent on each node.

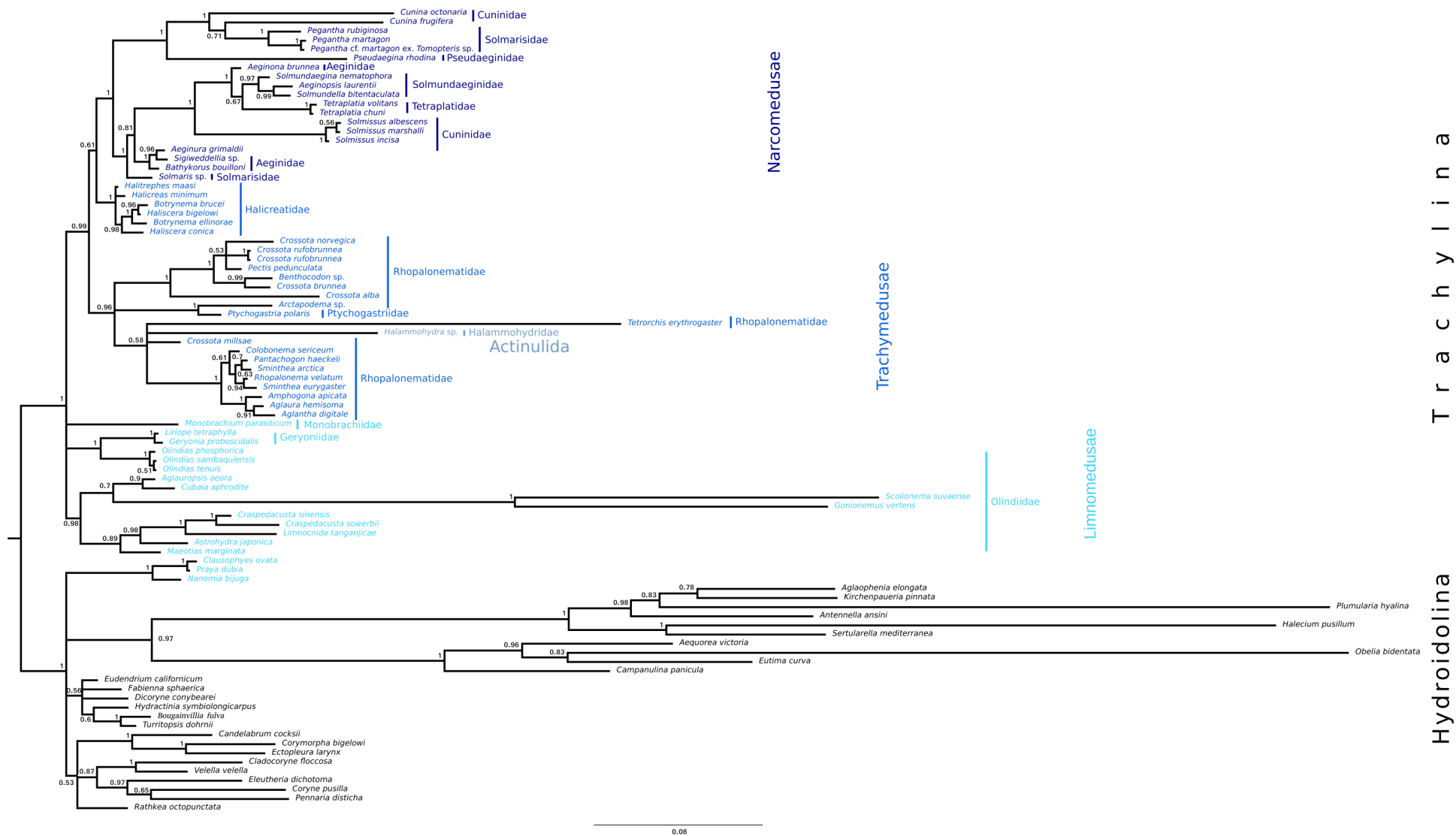


**Supplementary Fig. 3** Bayesian phylogeny of nuclear ribosomal 28S using the GTR+I+G model of nucleotide evolution. Posterior probabilities are shown on the nodes. Analysis was terminated when standard deviation of split frequencies fell below 0.01 after 1,365,000 iterations of the Markov Chain Monte Carlo (MCMC) run.

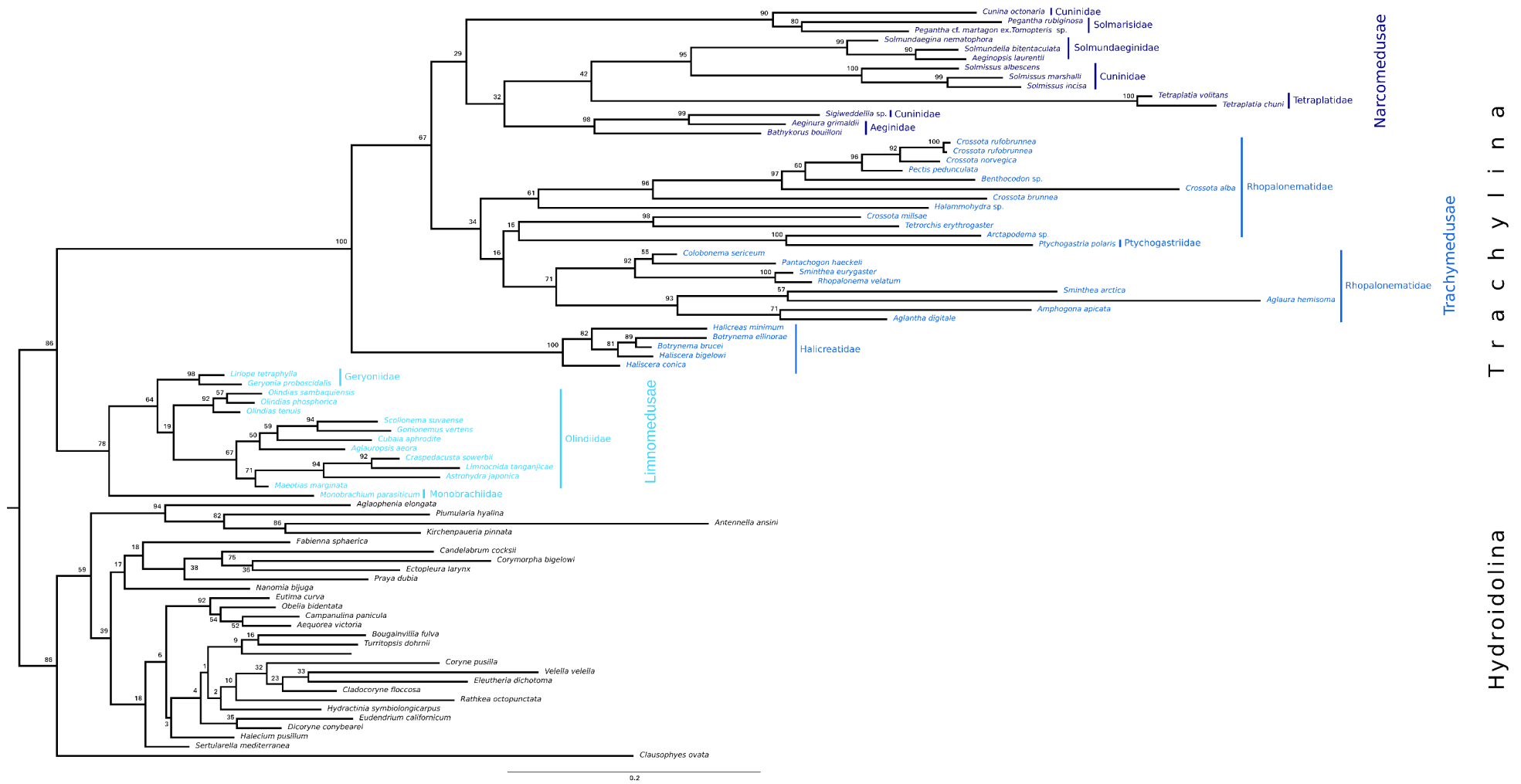


**Supplementary Fig. 4** Maximum likelihood phylogeny inferred from nuclear ribosomal 18S using the GTR+I+G model of nucleotide evolution.

Bootstrap support resulting from 1,000 non-parametric bootstrap replicates are shown in percent on each node.

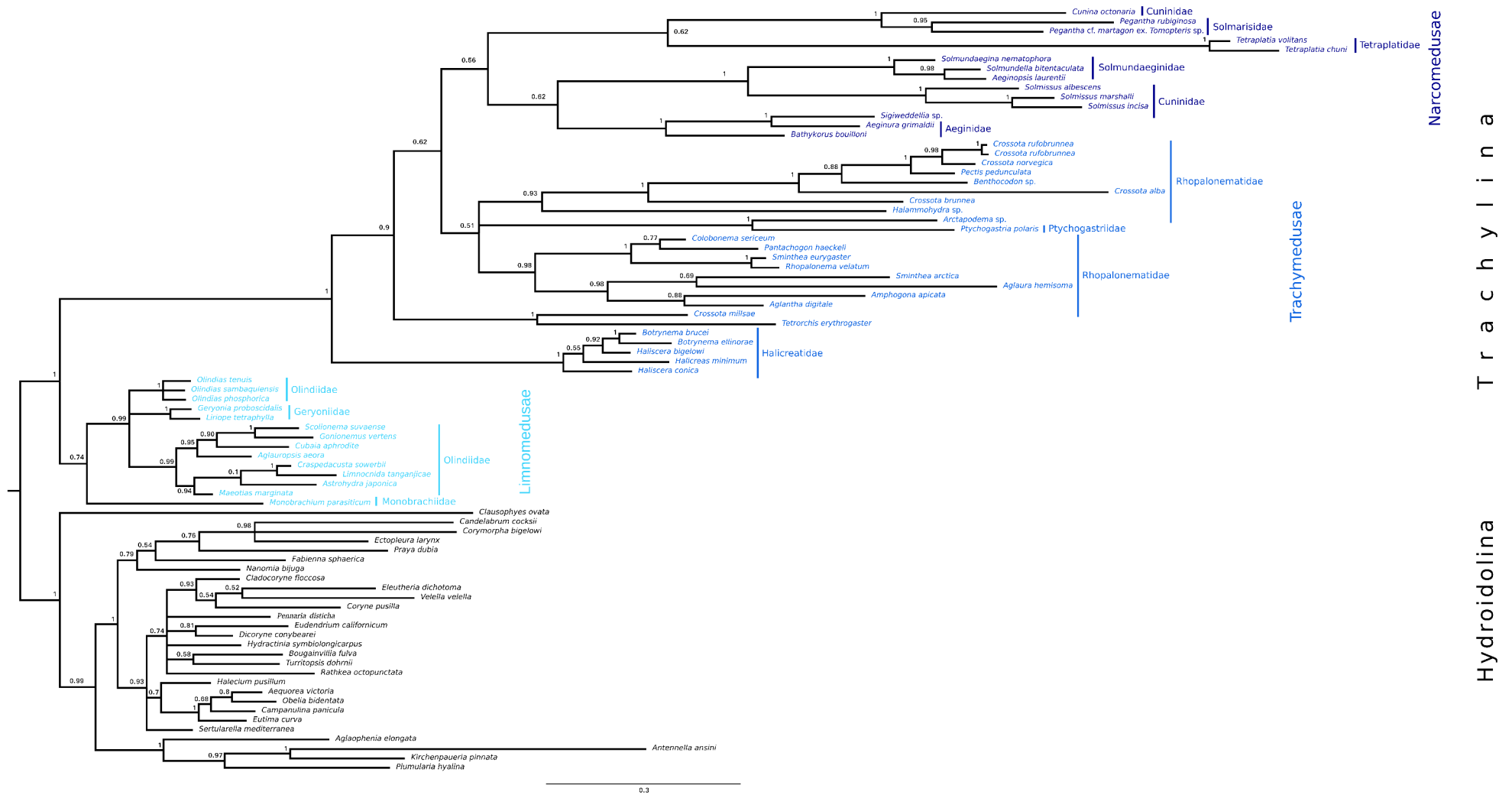


**Supplementary Fig. 5** Bayesian phylogeny of nuclear ribosomal 18S using the GTR+I+G model of nucleotide evolution. Posterior probabilities are shown on the nodes. Analysis was terminated when standard deviation of split frequencies fell below 0.01 after 1,630,000 iterations of the Markov Chain monte Carlo (MCMC) run.



**Supplementary Fig. 6** Maximum likelihood phylogeny inferred from nuclear ribosomal 16S using the GTR+I+G model of nucleotide evolution.

Bootstrap support resulting from 1,000 non-parametric bootstrap replicates are shown in percent on each node.



**Supplementary Fig. 7** Bayesian phylogeny of mitochondrial 16S using the GTR+I+G model of nucleotide evolution. Posterior probabilities are shown on the nodes. Analysis was terminated when standard deviation of split frequencies fell below 0.01 after 7,670,000 iterations of the Markov Chain monte Carlo (MCMC) run.

**Supplementary Table 1** Samples with GenBank accession numbers and voucher sample catalog numbers where applicable. Bold GenBank accession numbers indicate sequence data generated for this study. KUNHM and KUMIP: Biodiversity Institute & Natural History Museum, University of Kansas, Lawrence, KS, USA; NMST: National Science Museum of Tokyo; MHNG-INVE: Muséum d'histoire naturelle de Genève, Geneva, Switzerland; USNM: National Museum of Natural History, Smithsonian Institution, Washington, DC, USA; YPM: Peabody Museum of Natural History, Yale University, New Haven, CT, USA.

Classification				28S	18S	16S	Museum Accession Nos.
Trachylina	Actinulida	Halammohydridae	<i>Halammohydra</i> sp.	EU301623	EU301622	EU293991	USNM 1109974
Trachylina	Limnomedusae	Geryonidae	<i>Geryonia proboscidalis</i>	EU247807	EU247816	EU293979	
Trachylina	Limnomedusae	Geryonidae	<i>Liriope tetraphylla</i>	<b>MG979298</b>		<b>MG979365</b>	
Trachylina	Limnomedusae	Monobrachiidae	<i>Monobrachium parasiticum</i>	<b>MG979299</b>	AY920752	EU293970	USNM 1074993
Trachylina	Limnomedusae	Olindiidae	<i>Aglauropisis aeora</i>	AY920793	AY920754	EU293973	USNM 1073327
Trachylina	Limnomedusae	Olindiidae	<i>Astrohydra japonica</i>	<b>MG979300</b>		EU293975	
Trachylina	Limnomedusae	Olindiidae	<i>Craspedacusta sinensis</i>		EU247815	AY512507	
Trachylina	Limnomedusae	Olindiidae	<i>Craspedacusta sowerbii</i>	<b>MG979301</b>	<b>MG979336</b>	<b>MG979366</b>	
Trachylina	Limnomedusae	Olindiidae	<i>Cubaia aphrodite</i>	<b>MG979302</b>	<b>MG979337</b>	<b>MG979367</b>	
Trachylina	Limnomedusae	Olindiidae	<i>Gonionemus vertens</i>	<b>MG979303</b>	<b>MG979338</b>	EU293976	
Trachylina	Limnomedusae	Olindiidae	<i>Limnocnida tanganjicae</i>	AY920795	AY920755	<b>MG979368</b>	
Trachylina	Limnomedusae	Olindiidae	<i>Maeotias marginata</i>	EU247810	AF358056	AY512508	
Trachylina	Limnomedusae	Olindiidae	<i>Olindias phosphorica</i>	EU247808	AY920753	EU293978	MHNG-INVE29811
Trachylina	Limnomedusae	Olindiidae	<i>Olindias sambaquiensis</i>	<b>MG979304</b>	EU247814	EU293977	
Trachylina	Limnomedusae	Olindiidae	<i>Olindias tenuis</i>	<b>MG979305</b>	<b>MG979339</b>	<b>MG979369</b>	
Trachylina	Limnomedusae	Olindiidae	<i>Scolionema suvaense</i>	<b>MG979306</b>	<b>MG979340</b>	<b>MG979370</b>	
Trachylina	Narcomedusae	Aeginidae	<i>Aeginona brunnea</i>		KY007602		NSMT-Co1590
Trachylina	Narcomedusae	Aeginidae	<i>Aeginura grimaldii</i>	<b>MG979307</b>	KY007605	KY007590	
Trachylina	Narcomedusae	Aeginidae	<i>Bathykorus bouilloni</i>	<b>MG979308</b>	<b>MG979341</b>	<b>MG979371</b>	
Trachylina	Narcomedusae	Aeginidae	<i>Sigiweddellia</i> sp.	<b>MG979309</b>	KY007607	KY007593	
Trachylina	Narcomedusae	Cuninidae	<i>Cunina frugifera</i>	KY077276	AF358059	<b>MG979372</b>	
Trachylina	Narcomedusae	Cuninidae	<i>Cunina octonaria</i>	<b>MG979310</b>	KY007606	KY007592	
Trachylina	Narcomedusae	Cuninidae	<i>Solmissus albescens</i>	<b>MG979311</b>	<b>MG979342</b>	<b>MG979373</b>	
Trachylina	Narcomedusae	Cuninidae	<i>Solmissus incisa</i>	<b>MG979312</b>	KY007609	KY007596	
Trachylina	Narcomedusae	Cuninidae	<i>Solmissus marshalli</i>	AY920790	AF358060	EU294001	
Trachylina	Narcomedusae	Pseudaeginidae	<i>Pseudaegina rhodina</i>		EU247813		
Trachylina	Narcomedusae	Solmarisidae	<i>Pegantha cf martagon</i>	<b>MG979313</b>	<b>MG979343</b>	<b>MG979374</b>	USNM 1449088
Trachylina	Narcomedusae	Solmarisidae	<i>Pegantha martagon</i>	<b>MG979314</b>	<b>MG979344</b>	<b>MG979375</b>	
Trachylina	Narcomedusae	Solmarisidae	<i>Pegantha rubiginosa</i>	<b>MG979315</b>	<b>MG979345</b>	<b>MG979376</b>	
Trachylina	Narcomedusae	Solmarisidae	<i>Solmaris</i> sp.	<b>MG979316</b>	<b>MG979346</b>		
Trachylina	Narcomedusae	Solmundaeginidae	<i>Aeginopsis laurentii</i>	<b>MG979317</b>	<b>MG979347</b>	<b>MG979377</b>	



Trachylina		Narcomedusae	Solmundaeginidae	<i>Solmundaegina nematophora</i>	AY920789	AF358058	EU293997	
Trachylina		Narcomedusae	Solmundaeginidae	<i>Solmundella bitentaculata</i>	EU247795	EU247812	EU293998	MHNG-INVE 31746; USNM 1107456
Trachylina		Narcomedusae	Tetraplatidae	<i>Tetraplatia chuni</i>	<b>MG979318</b>	<b>MG979348</b>	KY007599	
Trachylina		Narcomedusae	Tetraplatidae	<i>Tetraplatia volitans</i>	DQ002502	DQ002501	EU293999	KUMIP 314322
Trachylina		Trachymedusae	Halicreatidae	<i>Botrynema brucei</i>	EU247798	EU247822	EU293982	
Trachylina		Trachymedusae	Halicreatidae	<i>Botrynema ellinorae</i>	<b>MG979319</b>	<b>MG979349</b>	<b>MG979378</b>	
Trachylina		Trachymedusae	Halicreatidae	<i>Halicreas minimum</i>	<b>MG979320</b>	<b>MG979350</b>	EU293983	USNM 1452233
Trachylina		Trachymedusae	Halicreatidae	<i>Haliscera bigelowi</i>	<b>MG979321</b>	<b>MG979351</b>	<b>MG979379</b>	USNM 1452232
Trachylina		Trachymedusae	Halicreatidae	<i>Haliscera conica</i>	EU247797	EU247825	EU293981	
Trachylina		Trachymedusae	Halicreatidae	<i>Halitrephes maasi</i>	<b>MG979322</b>	<b>MG979352</b>	<b>MG979380</b>	USNM 1452212
Trachylina		Trachymedusae	Ptychogastridae	<i>Ptychogastria polaris</i>	<b>MG979323</b>	<b>MG979353</b>	<b>MG979381</b>	
Trachylina		Trachymedusae	Rhopalonematidae	<i>Aglantha digitale</i>	<b>MG979324</b>	<b>MG979354</b>	EU293985	USNM 1073329
Trachylina		Trachymedusae	Rhopalonematidae	<i>Aglaura hemistoma</i>	<b>MG979325</b>	EU247820	EU293984	KUMIP 314323
Trachylina		Trachymedusae	Rhopalonematidae	<i>Amphogona apicata</i>	<b>MG979326</b>	<b>MG979355</b>	<b>MG979382</b>	
Trachylina		Trachymedusae	Rhopalonematidae	<i>Arctapodema</i> sp.	<b>MG979327</b>	<b>MG979356</b>	<b>MG979383</b>	
Trachylina		Trachymedusae	Rhopalonematidae	<i>Benthocodon</i> sp.	<b>MG979328</b>	<b>MG979357</b>	<b>MG979384</b>	USNM 1452215
Trachylina		Trachymedusae	Rhopalonematidae	<i>Colobonema sericeum</i>	<b>MG979329</b>	<b>MG979358</b>	<b>MG979385</b>	USNM 1452217
Trachylina		Trachymedusae	Rhopalonematidae	<i>Crossota alba</i>	<b>MG979330</b>	<b>MG979359</b>	<b>MG979386</b>	USNM 1452231
Trachylina		Trachymedusae	Rhopalonematidae	<i>Crossota brunnea</i>	<b>MG979331</b>	<b>MG979360</b>	<b>MG979387</b>	
Trachylina		Trachymedusae	Rhopalonematidae	<i>Crossota millsae</i>	<b>MG979332</b>	<b>MG979361</b>	<b>MG979388</b>	USNM 1452218
Trachylina		Trachymedusae	Rhopalonematidae	<i>Crossota norvegica</i>	<b>MG979333</b>	<b>MG979362</b>	<b>MG979389</b>	
Trachylina		Trachymedusae	Rhopalonematidae	<i>Crossota rufobrunnea</i>	EU247800	EU247824	EU293986	
Trachylina		Trachymedusae	Rhopalonematidae	<i>Crossota rufobrunnea</i>	EU247799	EU247823	EU293987	
Trachylina		Trachymedusae	Rhopalonematidae	<i>Pantachogon haeckeli</i>	AY920792	AF358062	KY077291	USNM 1452221 (paravoucher)
Trachylina		Trachymedusae	Rhopalonematidae	<i>Pectis pedunculata</i>	<b>MG979334</b>	<b>MG979363</b>	<b>MG979390</b>	USNM 1284394
Trachylina		Trachymedusae	Rhopalonematidae	<i>Rhopalonema velatum</i>	EU247804	EU247819	EU293992	
Trachylina		Trachymedusae	Rhopalonematidae	<i>Sminthea arctica</i>	<b>MG979335</b>	<b>MG979364</b>	<b>MG979391</b>	
Trachylina		Trachymedusae	Rhopalonematidae	<i>Sminthea eurygaster</i>		KY077284	KY077293	
Trachylina		Trachymedusae	Rhopalonematidae	<i>Tetrorchis erythrogaster</i>	KY077274	KY077285	EU293995	USNM 1452268
Hydroïdolina	Anthoathecata	Aplanulata	Candelabridae	<i>Candelabrum cocksii</i>	AY920796	AY920758	AY512520	MHNG-INVE29591
Hydroïdolina	Anthoathecata	Aplanulata	Corymorphidae	<i>Corymorpha bigelowi</i>	EU272563	EU272618	EU448099	KUNHM 2829
Hydroïdolina	Anthoathecata	Aplanulata	Tubulariidae	<i>Ectopleura larynx</i>	EU879943	EU876572	EU876545	KUNHM DIZ2963
Hydroïdolina	Anthoathecata	Capitata	Cladocorynidae	<i>Cladocoryne floccosa</i>	EU272551	EU272608	EU876554	
Hydroïdolina	Anthoathecata	Capitata	Cladonematidae	<i>Eleutheria dichotoma</i>	GQ424291	GQ424321	AY512538	
Hydroïdolina	Anthoathecata	Capitata	Corynidae	<i>Coryne pusilla</i>	GQ424304	AJ133558	AY512552	MHNG-INVE35756
Hydroïdolina	Anthoathecata	Capitata	Pennariidae	<i>Pennaria disticha</i>	GQ424316	GQ424342	AM088481	MHNG-INVE29809
Hydroïdolina	Anthoathecata	Capitata	Porpitidae	<i>Velella velella</i>	EU879949	EU876576	EU305487	
Hydroïdolina	Anthoathecata	Filifera I	Eudendriidae	<i>Eudendrium californicum</i>	EU305513	EU305492	EU305475	KUNHM2858
Hydroïdolina	Anthoathecata	Filifera II	Laingiidae	<i>Fabienna sphaerica</i>	AY920797	AY920767	AM183133	MHNG-INVE 33453
Hydroïdolina	Anthoathecata	Filifera III	Bougainvilliidae	<i>Dicoryne conybearei</i>	EU272559	EU272614	AM183141	MHNG-INVE 32949
Hydroïdolina	Anthoathecata	Filifera III	Hydractiniidae	<i>Hydractinia symbiolongicarpus</i>	EU272568	EU272621	FJ214380	
Hydroïdolina	Anthoathecata	Filifera IV	Bougainvilliidae	<i>Bougainvillia fulva</i>	EU305507	EU305490	EU305470	KUNHM 2816

Hydroidolina	Anthoathecata	Filifera IV	Oceaniidae	<i>Turritopsis dohrnii</i>	EU272596	EU272638	AY787889	MHNG-INVE 29753
Hydroidolina	Anthoathecata	Filifera IV	Rathkeidae	<i>Rathkea octopunctata</i>	EU272591	EU272634	EU305483	KUMIP 314321
Hydroidolina	Anthoathecata	Siphonophorae	Agalmatidae	<i>Nanomia bijuga</i>	EU272576	AY937338	AY935296	YPM 35043
Hydroidolina	Anthoathecata	Siphonophorae	Clausophyidae	<i>Kephyes</i> sp.	EU305508	AY937336	AY935294	YPM 35349
Hydroidolina	Anthoathecata	Siphonophorae	Prayidae	<i>Praya dubia</i>	EU305526	AY937326	AY935285	YPM 35346
Hydroidolina	Leptothecata	Macrocolonia	Aglaopheniidae	<i>Aglaophenia elongata</i>	FJ550450	FJ550593	FJ550508	MHNG-INVE37539
Hydroidolina	Leptothecata	Macrocolonia	Haleciidae	<i>Halecium pusillum</i>	FJ550437	FJ550580	FJ550499	MHNG-INVE36295
Hydroidolina	Leptothecata	Macrocolonia	Halopterididae	<i>Antennella ansini</i>	FJ550388	FJ550533	AY787890	MHNG-INVE32157
Hydroidolina	Leptothecata	Macrocolonia	Kirchenpaueriidae	<i>Kirchenpaueria pinnata</i>	FJ550435	FJ550578	AY787911	MHNG-INVE36294
Hydroidolina	Leptothecata	Macrocolonia	Plumulariidae	<i>Plumularia hyalina</i>	EU305525	EU305499	AY787913	MHNG-INVE25333
Hydroidolina	Leptothecata	Macrocolonia	Sertulariidae	<i>Sertularella mediterranea</i>	FJ550403	FJ550546	FJ550479	MHNG-INVE32948
Hydroidolina	Leptothecata	Statocysta	Aequoreidae	<i>Aequorea victoria</i>	AY920799	AF358077	EU305469	KUNHM 2867
Hydroidolina	Leptothecata	Statocysta	Campanulariidae	<i>Obelia bidentata</i>	FJ550446	AY789754	AY789815	MHNG-INVE37294
Hydroidolina	Leptothecata	Statocysta	Campanulinidae	<i>Campanulina panicula</i>	FJ550452	FJ550596	FJ550511	MHNG-INVE48748
Hydroidolina	Leptothecata	Statocysta	Eirenidae	<i>Eutima curva</i>	FJ550455	FJ550599	FJ550514	MHNG-INVE33468