

Supplementary material

Species richness of jellyfishes (Scyphozoa : Discomedusae) in the Tropical Eastern Pacific: missed taxa, molecules, and morphology match in a biodiversity hotspot

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Supplementary material

Photographing particular parts of jellyfish to identify species
(<http://scyphozoan.ucmerced.edu/wiki/Methods>)

IN PHOTOGRAPHIC TANK

1. Place jellyfish in a tank with a black background. The perradial canal should be facing the front of the tank. Include a scale bar of known size.



Pic. 1. Lateral view of whole animal.



Pic. 2. Lateral view of whole animal including a RGB swatch.



Pic. 3. Top view of the whole animal (exumbrella). Scale bar is demarcated at 10 mm intervals.



Pic. 4. Close-up of right quadrant.



Pic. 5. Close-up of bell margin.



Pic. 6. Close-up of tentacle.



Pic. 7. Close-up of oral arms.



Pic. 8. Whole animal, oral surfaces.

2. Lift up bell, oral arms to expose ends of manubrium.



Pic. 9. Close-up of manubrium/mouth.

ON PHOTOGRAPHIC TABLE

All pictures on the table should be taken without flash (unless indicated otherwise) and under two types of illumination:

- a) **Full transillumination.** Direct exposure to the underlying light source, which enhances contrast of opaque versus transparent structures.
- b) **Black background.** Cover the source of light with a black cloth, which emphasizes structures that are differentiable under reflected light.

Include a scale bar of known size.

1. Subumbrella face up, tentacles and oral arms display on the table.

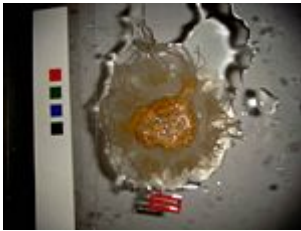
Measure Bell Diameter: _____ mm

Measure Bell Thickness:

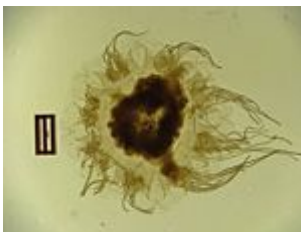
At center _____ mm

Midpoint _____ mm

At bell margin _____ mm

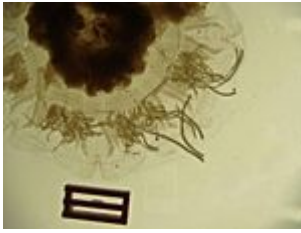


Pic. 10. Whole medusa, include RGB swatch (with flash). Block scale bar is 15.7 mm long and 7.7 mm wide.

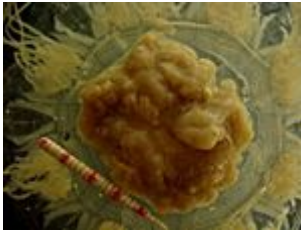


Pic. 11. Whole medusa

2. Move tentacles and oral arms from one quadrant.



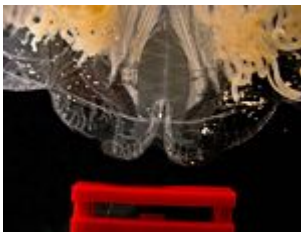
Pic. 12. Close-up of quadrant. Choose a quadrant that is not damaged and has developed normally (Note position relative to orientation in Pic. 1.)



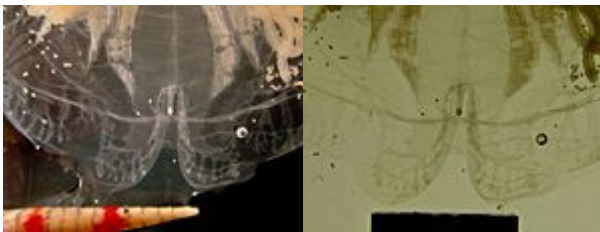
Pic. 13. Picture of center. Tooth-pick scale bar in left-hand image is demarcated at 1.0 mm intervals.



Pic. 14. Close-up of velar lappets.



Pic. 15. Close-up of rhopalial lappets.



Pic. 16. Close-up rhopalium.



Pic. 17. Close-up of coronal muscles.



Pic. 19. Close-up of radial muscles.



Pic. 20. Close-up of gastric cavity and gonads.



Pic. 21. Close-up of canals (two quadrants).

3. Move oral arms to top into a bundle (to reveal oral pillars)

Measure depth of oral pillar: _____ mm

Measure height of oral pillar: _____ mm

Measure width of oral pillar: _____ mm



Pic. 22. Close-up of oral arms (and any appendages thereon if pertinent for the taxon).



Pic. 23. Close-up of a single oral arm.

4. Flip animal, exumbrella face up.



Pic. 24. Whole animal exumbrella.



Pic. 31. Close-up of exumbrella (one quadrant).

Count the tentacles in a quadrant: _____

Table S1. List of all samples included in the study. Details of the locations codes are given in Table 1

Museum of Comparative Zoology, Harvard University (MCZ); National Museum of Natural History, Smithsonian (NMNH); California Academy of Sciences, San Francisco, CA (CAS); Instituto Nacional de Investigación y Desarrollo Pesquero, Mar del Plata, Argentina (INIDEP), University of California, Merced (MOD)

Species	Location Code	Catalogue No./Accession No.	Specimens
Family Pelagiidae			
<i>Chrysaora achlyos</i>	MXBSMAG	M0D006019M, M0D006020N, M0D006030X, M0D006031Y, M0D006032Z, M0D006033A, M0D006034B, M0D006035C	M0D006019M
<i>Chrysaora colorata</i>	USCAMBQ	M0D022665S, M0D022666T, M0D022667U	–
<i>Chrysaora chinensis</i>	MYBJJGG; THKRKOP	M0D022639S, M0D022643W, M0D022644X, M0D022683I; M0D022671Y	–
<i>Chrysaora fulgida</i>	NGXXGGI	M0D022655I	–
<i>Chrysaora fuscescens</i>	USCAMBQ; USCAXXX	M0D014611Y; M0D020074B	–
<i>Chrysaora hysocella</i>	GBXXNTS	M0D037294V	–
<i>Chrysaora lactea</i>	BRRJRIO	M0D014610X	–
<i>Chrysaora melanaster</i>	USALBER	KJ026151.1, KJ026152.1, KJ026153.1, KJ026154.1, KJ026155.1	–
<i>Chrysaora pacifica</i>	JPXXXX	M0D022681I	–
<i>Chrysaora plocamia</i>	CLANMJL	M0D022677E, M0D022678F, M0D022679G	–
<i>Chrysaora quinquecirrha</i>	USNCORI; MXTBARR, MXTBMEC	M0D020068V–M0D020070X; M0D014126H; M0D014731O, M0D014732P	M0D020069W, M0D020070X; M0D014126H; M0D014731O, M0D014732P
<i>Chrysaora</i> sp. 1	MXSOGSC	M0D014009U–M0D014012X, M0D014015A–M0D014018D, M0D014021G, M0D014026L	M0D014007S, M0D014008T, M0D014011W, M0D014020F, M0D014021G
<i>Chrysaora</i> sp. 2	MXSOBKN	M0D014070D, M0D014077K, M0D014078L, M0D014081O, M0D014082P, M0D014087U, M0D014088V, M0D014091Y, M0D014093A, M0D014099G, M0D0140100H, M0D0140101I, M0D0140102J, M0D014158N, M0D014159O	M0D014070D, M0D014072F, M0D014075I, M0D014077K, M0D014078L

Table S1. Continued

Species	Location Code	Catalogue No./Accession No.	Specimens
<i>Chrysaora</i> sp. 3	SVUNBES; SVUNGFO; NICIGFO; NIMNMAS; NIMNSAN; CRGUCUJ; CRPUICH; CRGUCLB; CRPUDOM	M0D015866F; M0D015910X, M0D015931S, M0D015932T; M0D016154H–M 0D016156J; M0D016185M, M0D016186N; M0D018435A, M0D018452R; M0D020169S–M0D020171U, M0D020192P; M0D020196T, M0D020197U; M0D020199W, M0D020200X, M0D021266X; M0D021294Z, M0D021296B, M0D021297C	M0D015866F; M0D015910X; M0D016154H; M0D020171U; M0D020197U; M0D020200X; M0D021294Z
<i>Chrysaora</i> sp. 4	PAPAGOR	M0D020100B, M0D020101C, M0D020107I, M0D020111M, M0D020112N, M0D020114P	M0D020100B, M0D020101C, M0D020107I, M0D020111M, M0D020112N
<i>Chrysaora</i> sp. 5	NIANBWI; NIANUSP	M0D016023G, M0D016025I; M0D016141U–M0D016143W	M0D016023G, M0D016025I; M0D016141U– M0D016143W
<i>Chrysaora</i> sp. 6	PABTBDE; CRLMPMO	M0D021394V–M0D021396X; M0D021364R	M0D021394V–M0D021398Z
<i>Chrysaora</i> sp.	NGXXGGI	M0D022654H	–
<i>Sanderia malayensis</i>	USCTNOQ	M0D022660N, M0D022661O, M0D022664R	MCZ1927; NMNH29772
<i>Sanderia</i> sp. 1	SVUNBES; SVUNESP; NIMNMAS	M0D015848N–M0D015850P; M0D018393K; M0D018437C, M0D018451Q, M0D018456V	M0D015848N–M0D015850P; M0D018437C; M0D018456V
<i>Sanderia</i> sp. 2	CRGUCLB	M0D020198V	M0D020198V
<i>Mavia benovici</i>		KJ573410.1–KJ573414.1	–
<i>Pelagia noctiluca</i>	MXBSLOZ; MXOAPAN; CRPUDOM	M0D006021O–M0D006023Q; M0D020012R, M0D020013S, M0D020021A; M0D021332L–M0D021334N	M0D020013S; M0D021333M, M0D021335O, M0D021336P; M0D014612Z; MCZ1404; MCZ3436; MCZ (###)
<i>Pelagia panopyra</i> cf	IDPAGFC; IDPAGFI; IDPAPYK	M0D001464H; M0D001483A; M0D007198V, M0D007202Z– M0D007204B	M0D007198V–M0D007203A; MCZ1944
<i>Pelagia</i> sp. 1	VENEZIM	M0D014907I–M0D014909K	–
Family Drymonematidae			
<i>Drymonema dalmatinum</i>	TRIZFOC	HQ234621.1, HQ234617.1, HQ234616.1, HQ234615.1 HQ234614.1	7§
<i>Drymonema gorgo</i>	ARBABBL	–	1§ MCZ8079, MCZ8080

Table S1. Continued

Species	Location Code	Catalogue No./Accession No.	Specimens
<i>Drymonema larsoni</i>	USFLAMS; USALDIS	HQ234618.1–HQ234620.1; HQ234622.1, HQ234610.1, HQ234611.1, HQ234612.1, HQ234613.1, HQ234650.1	10 §
<i>Drymonema</i> sp. 1	MXOASCZ; NIMNMAS; NIMNSAN; NILETRA	M0D020005K, M0D020010P, M0D020011Q; M0D018444J; M0D016153G; M0D020002H	M0D020005K, M0D020010P; M0D018444J; M0D016153G; M0D020002H
Family Ulmaridae			
<i>Aurelia aurita</i>	CLVSMAR	M0D020052F	MCZ3307, MCZ6015
<i>Aurelia</i> sp. 9	MXTBCAR	M0D014701K–M0D014705O	M0D014701K–M0D014703M
<i>Aurelia</i> sp. 12	MXBSBAP	M0D006054V–M0D006059A, M0D006068J, M0D014842V	M0D006054V, M0D006058Z, M0D006059A, M0D006068J
<i>Aurelia</i> sp. 13	SVUNESP; NILETRA; CRGUCUJ	M0D018376T–M0D018379W; M0D018460Z, M0D020000F; M0D020159I–M0D020161K	M0D020163M–M 0D020168R
<i>Aurelia</i> sp. 14	PAPAGPA	M0D014904F–M0D014906H	–
<i>Aurelia</i> sp. 15	PATBBDE	M0D021365S–M0D021367U	M0D021370X, M0D021374B, M0D021377E
<i>Aurelia</i> sp. 16	ARBABSB	M0D014936L–M0D014938N	–
<i>Aurelia</i> sp.	Caribbean	–	CAS108710
Family Cassiopeidae			
<i>Cassiopea andromeda</i>	MXBSISJ	M0D006024R–M0D006026T	–
<i>Cassiopea frondosa</i>	PATBBDE	M0D021380H–M0D021382J	–
<i>Cassiopea xamachana</i> cf	PATBBDE	M0D021379G; M0D021383K; M0D021345M	–
Family Mastigiidae			
<i>Phyllorhiza punctata</i>	MXBSAGO; MXBSCPC	M0D014780L, M0D014781M; M0D014783O	–
<i>Phyllorhiza pacifica</i>	THKRKOP; THKRKOB	M0D022673A; M0D022675C	–

Table S1. Continued

Species	Location Code	Catalogue No./Accession No.	Specimens
Family Lobonematidae			
<i>Lobonema smithii</i>	MYSLJGG; THKRKOP	M0D021410L, M0D021411M, M0D22651E, M0D022652F; M0D022670X	M0D022652F
Gen. 1 sp. 1	MXBSBAP; MXBSAGO; MXBSCPC	M0D0006067I, M0D014775G, M0D014776H; M0D014768Z, M0D014770B	M0D0006067I; M0D014775G, M0D014777I; M0D014768Z, M0D014770B
Gen. 1 sp. 2	SVUNCOQ	M0D018374R	–
Gen. 1 sp. 3	PAPATOC	M0D020075C	M0D020075C
Gen. 1 sp. 4	SVUNGFO	M0D018375S	–
Family Catostylidae			
<i>Acromitus flagellatus</i>	IDJISUY	M0D21416R, M0D021418T	–
<i>Catostylus townsendi</i>	IDJISUY; MYSLJGG	M0D021427C; M0D022653G, M0D022684L	–
Catostylidae sp. 1	SVUNBES; SVUNGFO; SVUSBJQ; NIMNSAN; NICIGFO	M0D015851Q–M0D015854T; M0D015886Z, M0D015890D, M0D015948J, M0D016248X; M0D015997G, M0D015999I, M0D0160050; M0D016158L–M0D016160N; M0D016161O, M0D016162P	M0D015851Q–M0D015854T, M0D015856J; M0D015997G, M0D015999I; M0D016159M, M0D016160N; M0D016175C, M0D016182J
Catostylidae sp. 2	CRPUDOM	M0D021319Y	M0D021319Y
<i>Cambriionella</i> sp.	USCAMBQ	M0D022684L	–
Family Lychnorhizidae			
<i>Lychnorhiza lucerna</i>	NIANGUI, NIANGBW, NIANTUP, ARBABS	M0D016016Z; M0D016088T; M0D016128H–M0D016130J	M0D016016Z; M0D016088T; M0D016128H – M0D016130J; INIDEP-CC0106-EG38, INIDEP- CC0500-GG27-MR2
<i>Lychnorhiza</i> sp. 1	MXOASCZ; SVUNTUN; NIMNMAS; CRPUDOM; PAPAGOR; PAPATOC	M0D020006L–M0D020008N; M0D016187O; M0D018419K– M0D018422N; M0D021295A, M0D021299E, M0D021303I; M0D020086N, M0D020087O, M0D020089Q; M0D020093U	M0D020006L; M0D016187O; M0D018420L– M0D018422N; M0D021295A; M0D020078F, M0D020086N–M0D020088P, M0D020092T
<i>Lychnorhiza</i> sp. 2	CRLMGAN	M0D021350D–M0D021352F	M0D021350D–M0D021354H
<i>Lychnorhiza</i> sp. 3	VENEZIM	M0D014910L, M0D014911M	–

Table S1. Continued

Species	Location Code	Catalogue No./Accession No.	Specimens
Family Cepheidae			
<i>Marivagia stellata</i>	THKRRAY	M0D022674B	–
Family Rhizotostomidae			
<i>Rhopilema hispidum</i>	MYSLJGG	M0D022638R	–
Family Stomolophidae			
<i>Stomolophus meleagris</i>	USNCXXX; USALDIS; MXTBARR; MXTBCAR; MXTBMEC	M0D020054H; M0D014966P–M0D014979C; M0D014113U, M0D014640B–M0D014645G, M0D014147C, M0D014148D, M0D014668D–M0D014700J, M0D014728L, M0D014729M; M0D014730N	MCZ3310, MCZ383; M0D014147C, M0D014641C, M0D014669E; M0D014700J; M0D014730N
<i>Stomolophus</i> sp. 1	MXSOGSC	M0D006069K–M0D006075Q, M0D006086B–M0D006088D, M0D014000L–M0D014003O, M0D014005Q	M0D006072N, M0D006075Q, M0D006088D, M0D014003O, M0D014005Q
<i>Stomolophus</i> sp. 2	MXBSBAP; MXBSLOZ; MXSOGUY; MXBSCPC; MXBSMUL; MXSOBKN; MXBNGOZ	M0D006060B–M0D006065G; M0D006066H; M0D014029O, M0D014030P, M0D014032R, M0D014040Z, M0D014041A, M0D014046F–M0D014049I, M0D014056P, M0D014063W, M0D014066Z–M0D014068B; M0D014795A–M0D014797C, M0D014800F, M0D014806L–M0D0148090, M0D014815U– M0D014819Y, M0D014822B, M0D014823C; M0D014849C– M0D014851E, M0D014853G–M0D014855I, M0D014864R– M0D014866T, M0D014873A–M0D014879G; M0D014090X; M0D021412N	M0D006060B, M0D006061C; M0D014047G, M0D014063W; M0D014796B, M0D014797C; M0D014865S, M0D014866T
<i>Stomolophus</i> sp. 3	SVUNBES; SVUSCOB; CRGUCLB; CRPUNCY; CRPUDOM; PAPACOR	M0D015960V–M0D015974J; M0D016012V; M0D020193Q– M0D020195S; M0D021275G, M0D021276H, M0D021278J– M0D021286R; M0D021293Y; M0D020122X, M0D020123Y	M0D015960V, M0D015961W, M0D015964Z; M0D020195S; M0D021277I, M0D021279K
<i>Stomolophus</i> sp. 4	PAPATOC, PAPAPAV	M0D020076D, M0D020077E, M0D020079G, M0D020080H; M0D020142R–M0D020147W, M0D020152B, M0D020153C	M0D020076D, M0D020079G, M0D020080H; M0D020144T, M0D020145U
<i>Stomolophus</i> sp. 5	NIANGBW, NIANGUI, NIANTUP	M0D016089U–M0D016092X; M0D016014X, M0D016015Y, M0D016094Z, M0D016099E, M0D016102H, M0D016106L, M0D016112R, M0D016114T; M0D016125E–M0D016127G	M0D016102H, M0D016113S, M0D016117W, M0D016118X; M0D016126F
<i>Stomolophus</i> sp. 6	MXSOBKN	M0D014112T	–

Table S2. List of primersPrimer combinations are denoted by the superscript number (ⁿ); primers used for sequencing only (*)

Loci	Primer	Sequence (5'-3')	Source
COI	LCOjf ¹	GGTCAACAAATCATAAAGATATTGGAAC	Dawson, 2005
	HCO2198 ^{1, 2, 3, 8, 9, 11}	TAAACTTCAGGGTGACCAAAAAATCA	Folmer <i>et al.</i> 1994
	St COI F10 31 ²	GATATTCGGAGCT	This study
	Cass COI 120375 F ³	ATYAGGAGCAGGATTCAGTATG	This study
	Acro LCOI 8 ^{4, 6}	CGGTGCTTTTTTCAGCAATGAT	K. Bayha unpublsh data
	Acro LCOI 8deg ^{5, 7}	CGGTGCTTTTTYTCAGCAATGAT	K. Bayha unpublsh data
	Acro HCO 611 ^{4, 5}	AGCAGGGTCGAAGAAAGATGTATT	Bayha and Dawson, 2010
	Acro HCO 611deg ^{6, 7}	AGCAGGRTCGAARAADGABGTATT	K. Bayha unpublsh data
	Chry sp5 F COI ⁸	GAT TGG CACAGCTTTTAGTAT G	This study
	Chry sp3 F COI ⁹	GATTGGCACAGCTTTTAGTATG	This study
	Chry Atlan F2 ^{10, 11}	GCATTCTCCGCAATGATAGG	This study
Chry Atlan R1 ¹⁰	TTCTGGGTGACCAAAGAACC	This study	
16S	16sL ¹	GACTGTTTACCAAAAAACATA	Ender and Schierwater, 2003
	Aa H16S 15141H ¹	AGATTTTAATGGTCGAACAGAC	Bayha and Dawson, 2010
	Hydro16Sar ²	TCGACTGTTTACCAAAAAACATAGC	Cunningham and Buss, 1993
	Hydro16Sbr ²	ACGGAATGAACTCAAATCATGTAAG	Cunningham and Buss, 1993
28S	Aa L28S 21 ^{1, 3}	GAACRGCTCAAGCTTTRAAATCT	Bayha <i>et al.</i> 2010
	Aa H28S 1078 ¹	GAAACTTCGGAGGGAACCAGCTAC	Bayha <i>et al.</i> 2010
	Aa L28S 48 ²	GCTTGCAACAGCGAATTGTA	Bayha <i>et al.</i> 2010
	Aa H28S 1039 ^{2, 3, 4}	GTCTTCGCCCCATATACCCA	Bayha <i>et al.</i> 2010
	Cassiopea 28S F ⁴	GRCGGCGAATTGTAGTCTCGA	This study
18S	18Sa ^{1, 4}	AACCTGGTTGATCCTGCCAGT	Medlin <i>et al.</i> 1988
	18Sb ¹	GATCCTTCTGCAGGTTACCTAC	Medlin <i>et al.</i> 1988
	L *	CCAACACTACGAGCTTTTTAACTG	Apakupakul <i>et al.</i> 1999
	C *	CGGTAATTCCAGCTCCAATAG	Apakupakul <i>et al.</i> 1999
	Aa L18S 1159 *	CGGAAGGGCACCACCAGGAG	Bayha <i>et al.</i> 2010
	Aa H18S 1318 *	CAGACAAATCACTCCACCAAC	Bayha <i>et al.</i> 2010
	Aa L18S 12 ^{1, 2}	TCCTGCCAGTAGTCATATGCTTG	Bayha <i>et al.</i> 2010
	Aa H 18S 1798 ²	CCTACGGAAACCTTGTTACGA	Bayha <i>et al.</i> 2010
	Cassiopea 18S L ³	GCACCTGTACTGTGAAACTGCG	This study
Cassiopea 18S H ^{1, 3}	CTTCCTCAAATGATCG	This study	

References

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Table S3. Thermocycle conditions used to amplify COI, 16S, 28S, and 18S

Loci	Holds	Denaturation	Annealing	Elongation	Number of cycles	Final elongation	Reference
	94°C for 480 s 51–57°C for 120 s 72°C for 120 s 94°C for 240 s 51–56°C for 120 s 72°C for 120 s	94°C for 45 s	50–55°C for 45–60 s	72°C for 60 s	33-35	72°C for 600 s	Modified from Dawson and Jacobs (2001)
COI	94°C for 240 s	94°C for 45 s	47–52°C for 50–70 s	72°C for 60 s	33-35	72°C for 600 s	
	94°C for 480 s 48–50°C for 120 s 72°C for 120 s 94°C for 240 s 49–54°C for 120 s 72°C for 120 s	94°C for 45 s	50–52°C for 45–60 s	72°C for 60 s	33-35	72°C for 600 s	
16S	94°C for 480 s	94°C for 45 s	50–52°C for 45 s	72°C for 60 s	33-35	72°C for 300 s	
	94°C for 240 s	94°C for 45 s	47–55°C for 60–90 s	72°C for 70–90 s	38	72°C for 600 s	
	94°C for 120 s	94°C for 45 s	48°C for 60 s	72°C for 90 s	38	72°C for 600 s	Modified from Bayha <i>et al.</i> (2010)
28S	94°C for 480 s 49–54°C for 120 s 72°C for 120 s 94°C for 240 s 50–54°C for 120 s 72°C for 120 s	94°C for 45 s	50–54°C for 60 s	72°C for 70–90 s	38	72°C for 600 s	
	94°C for 120 s	94°C for 45 s	48°C for 60 s	72°C for 90 s	38	72°C for 600 s	Modified from Bayha <i>et al.</i> (2010)
18S	94°C for 240 s	94°C for 45–50 s	47–54°C for 70 s	72°C for 70–90 s	38	72°C for 600 s	
	94°C for 240 s	94°C for 15–20 s	45–47°C for 15-20 s	70°C for 90 s	35	72°C for 420 s	Modified from Apakupakul <i>et al.</i> (1999)

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Table S4. Picture list for the photographic session, including the quantitative and meristic features emphasized in each image

The use of the color swatch (CMYK) is only for specimens collected recently. Specimens from museums or that have been preserved in formalin for long periods of time then the color swatch is not necessary

No.	Description
Tank	
1	Label (catalogue number)
2	Lateral view whole animal, camera in the front
3	Lateral view whole animal, camera in the front (include a CMYK)
4	Lateral view whole animal Side
5	Whole animal, camera from top (include a CMYK)
6	Close-up front/right quadrant, camera in the front or side
7	Close-up bell margin, camera in the front or side
8	Close-up of tentacle, camera in the front or side
9	Close-up of oral arms, camera in the front or side
10	Close-up of oral arm filaments
11	Close-up of terminal clubs, camera in the front or side
12	Close-up of mouthlets, camera in the front
13	Close-up of scapulae, camera in the front or side
14	Close-up of scapular filaments
15	Close-up of scapular filaments (include a CMYK)
Position	Lift up bell, drape oral arms to expose ends of manubrium
16	Close-up of manubrium/mouth
17	Oral side up from top
Acrylic Table	
Position	Subumbrella up (face up oral-aboral), tentacles/oral arms out Measure diameter of the bell diameter _____ Measure bell thickness 1)____ 2)____ 3)____ Measure of the oral disk thickness 1)____ 2)____ 3)____ Measure diameter of oral disk _____
18	Whole medusa, (include a CMYK) with flash
19	Whole medusa, bottom illuminated with black background
20	Whole medusa, full transillumination
Position	Move tentacles and/or oral arms from quadrant
21	Close-up of quadrant, bottom illuminated with black background
22	Close-up of quadrant, no illumination with black background
23	Picture of center, bottom illuminated with black background
24	Picture of center, full transillumination
25	Close-up of velar lappets, bottom illuminated with black background
26	Close-up of velar lappets, full transillumination
27	Close-up of rhopaliar lappets, bottom illuminated with black background
28	Close-up of rhopaliar lappets, full transillumination
29	Close-up of rhopalium, bottom illuminated with black background

Table S4. Continued

No.	Description
30	Close-up of rhopalium, full transillumination Rhopalium pit depth _____ millimeters
31	Close-up of coronal muscles, bottom illuminated with black background
32	Close-up of coronal muscles, full transillumination
33	Close-up of radial muscles, bottom illuminated with black background
34	Close-up of radial muscles, full transillumination
35	Close-up of gonad, bottom illuminated with black background
36	Close-up of gonad, full transillumination
37	Close-up of canals two quadrants, bottom illuminated with black background
38	Close-up of canals two quadrants, full transillumination
Position	Move oral arms to top in a group - reveal oral pillars
39	Close-up of oral pillar, bottom illuminated with black background
40	Close-up of oral pillar, full transillumination Measure depth of oral pillar _____ Measure height of oral pillar _____ Measure the wide of oral pillar _____
41	Close-up of subumbrellar papillae, bottom illuminated with black background
42	Close-up of subumbrellar papillae, full transillumination
Position	Splay the half of oral arms and terminal clubs out
43	Close-up of oral arms/terminal clubs, bottom illuminated with black background
44	Close-up of oral arms/terminal clubs, full transillumination
Position	Splay single oral arm out (winged portion), expose fenestrations
45	Close-up of single oral arm, bottom illuminated with black background
46	Close-up of single oral arm, full transillumination
Position	Splay out scapulae as with oral arm (above)
47	Close-up of scapula, bottom illuminated with black background
48	Close-up of scapula, full transillumination Quadralinga present or absent Number of subumbrellar radial furrows _____ (per quadrant)
Position	Flip animal so exumbrella faces up (face up aboral-oral)
49	Close-up of exumbrella quadrant, bottom illuminated with black background
50	Close-up of exumbrella quadrant, full transillumination
51	Whole animal exumbrella, bottom illuminated with black background
52	Whole animal exumbrella, full transillumination
Position	If dying canals possible - flip animal and dye canals
53	Close-up of dyed canals 2 quadrants, full transillumination

Table S5. Morphometric and meristic morphological features and their states

The morphological matrix is a modification and compilation of those characters that have been previously proven to be helpful to assess the morphological differences in several families and genera of scyphozoans (Gershwin and Collins 2002; Dawson 2003; Marques and Collins 2004; Dawson 2005a, b, c; Morandini and Marques 2010), and new features that primary literature suggest may be informative (Mayer 1910; Stiasny 1921, 1922; Rao 1932)

No.	Description	Features states
1	Symmetry of medusa	radial = 0, biradial = 1, tri-radial = 2 radial tetramerous = 3, pentamerous = 4
2	Gastric filaments	absent = 0, present = 1
3	Coronal muscle	well developed = 0, marginal and tiny = 1
4	Velum-like structure	absent = 0, velum = 1, velarium = 2
5	Umbrellar margin	smooth and continuous (no clefts, no lappets) = 0, clefts (or peronia) and lappets = 1, clefts and lobes = 2
6	Velar lappets bifurcated	no = 0, yes = 1
7	Number of velar lappets	count per octant
8	Number of bifurcated lappets	count per octant
9	Velar lappet length	millimeters
10	Velar lappet width	millimeters
11	Velar lappet shape	symmetric square = 0, symmetric semi-circular = 1, symmetric semi-oval=2, symmetric tapering = 3, asymmetric square = 4, asymmetric semi-circular = 5, asymmetric semi-oval = 6, asymmetric tapering = 7
12	Velar lappets in heterogenous size classes	no = 0, yes = 1
13	Number of lobes	count per quadrant
14	Primary lobe cleft depth	millimeters
15	Secondary lobe cleft depth	millimeters
16	Number of rhopalial lappets	count per rhopalium
17	Rhopalial lappet length (cleft depth)	millimeters
18	Rhopalial lappet width	millimeters
19	Rhopalial lappet shape	symmetric square = 0, symmetric semi-circular = 1, symmetric semi-oval=2, symmetric tapering = 3, asymmetric square = 4, asymmetric semi-circular = 5, asymmetric semi-oval = 6, asymmetric tapering = 7
20	Rhopalia in marginal clefts	no = 0, yes = 1
21	Number of umbrella tentacles	count per quadrant
22	Number of secondary tentacles	count per quadrant
23	Number of tertiary tentacles	count per quadrant
24	Tentacular insertion	at umbrella margin = 0, proximally on exumbrella = 1, distally on exumbrella = 2, proximally on subumbrella = 3, distally on subumbrella = 4
25	Structure of medusoid tentacles	hollow = 0, solid = 1
26	Tentacular morphology	straight = 0, with angular inflection = 1, capitate = 2
27	Number of tentacle whorls or rows	count

Table S5. Continued

No.	Description	Features states
28	Tentacle position	perradial only = 0, interradial only = 1, adradial only = 2, perradial + interradial = 3, perradial + adradial = 4, interradial + adradial = 5, perradial + interradial + adradial = 6
29	Tentacle arrangement	single/continuous = 0, clumped = 1
30	Tentacular bulbs	absent = 0, present = 1
31	Tentacles with terminal knob	absent = 0, present (i.e. capitate) = 1
32	Gastric mesenteries	absent = 0, present = 1
33	Number of gastric ostia	count
34	Gastric ostia position	perradial only = 0, interradial only = 1, adradial only = 2, perradial + interradial = 3, perradial + adradial = 4, interradial + adradial = 5, perradial + interradial + adradial = 6
35	Number of radial mesenteries	count
36	Radial mesentery shape	straight = 0, bent distally = 1, paired forming Y proximally = 2
37	Radial mesentery termination	percent of distance from tentacle (0%) to rhopalium (100%)
38	Number of radiating stomach pouches	count
39	Radial canals	absent = 0, present = 1
40	Number of perradial canal origins at the gastrovascular cavity	count per quadrant
41	Number of interradial canal origins at the gastrovascular cavity	count per quadrant
42	Number of adradial canal origins at the gastrovascular cavity	count per quadrant
43	Number of perradial-perradial anastomoses in radial canals that are circumscribed by the ring canal	count per quadrant
44	Number of interradial-interradial anastomoses in radial canals that are circumscribed by the ring canal	count per quadrant
45	Number of adradial-adradial anastomoses in radial canals that are circumscribed by the ring canal	count per quadrant
46	Number of perradial-interradial anastomoses in radial canals that are circumscribed by the ring canal	count per quadrant
47	Number of perradial-adradial anastomoses in radial canals that are circumscribed by the ring canal	count per quadrant
48	Number of interradial-adradial anastomoses in radial canals that are circumscribed by the ring canal	count per quadrant
49	Number of terminations of perradial canals at the ring canal	count per quadrant
50	Number of terminations of interradial canals at the ring canal	count per quadrant
51	Number of terminations of adradial canals at the ring canal	count per quadrant
52	Number of perradial canals originating distally at the circular canal	count per quadrant
53	Number of interradial canals originating distally at the circular canal	count per quadrant
54	Number of adradial canals originating distally at the circular canal	count per quadrant
55	Number of sinuses originating at the gastrovascular cavity	count per quadrant
56	Number of sinuses originating at the perradial canal	count per quadrant
57	Number of sinuses originating at the interradial canals	count per quadrant
58	Number of sinuses originating at the adradial canals	count per quadrant
59	Number of sinuses originating proximally at the circular canal	count per quadrant

Table S5. Continued

No.	Description	Features states
60	Number of anastomoses circumscribed by the circular canal that lead to two sinuses	count per quadrant
61	Number of sinuses originating distally at the circular canal	count per quadrant
62	Percentage of radius of medusa in which there is no branching radial canal	per quadrant
63	Ring canal	absent = 0, weakly developed chain of enlarged branches circumscribes bell = 1, a primary artery easily distinguishable from other canals circumscribes bell = 2
64	Furrow in bell	absent = 0, coronal groove = 1, laingiomedusan type = 2
65	Number of gonads	count
66	Gonads are paired	no = 0, yes = 1
67	Gonad position axis	perradial only = 0, interradial only = 1, adradial only = 2, perradial + interradial = 3, perradial + adradial = 4, interradial + adradial = 5, perradial + interradial + adradial = 6
68	Lateral distance from center to most proximal portion of gonad	millimeters
69	Lateral distance from center to most distal portion of gonad	millimeters
70	Gonad associated with particular structure	manubrium = 0, radial canals = 1, gastric septa or quadralinga = 2, radial septa = 3, pouch = 4, out folded pockets = 5, stomach arms = 6
71	Bell thickness	millimeters (center; 1/3; edge)
72	Mouth lips	absent = 0, simple lips = 1, gelatinous or curtain-like arms = 2, oral arms with suctorial mouths = 3
73	Manubrium	absent = 0, basal in arms = 1, basal and extended beyond arms = 2, pillars and disk = 3
74	Manubrium depth	millimeters
75	Manubrium width at base	millimeters
76	Manubrium width at mouth	millimeters
77	Length of the simple, unwinged portion of the oral arm	millimeters
78	Length of the winged portion of the oral arm	millimeters
79	Oral arm width	millimeters
80	Cross-sectional form of oral arm	sheet-like = 0, two-winged = 1 three-winged = 2
81	Secondary structure of oral arm	absent = 0, spiral = 1
82	Number of fenestrations in oral arm	count
83	Scapulae	absent = 0, present = 1
84	Point of scapula attachment to oral mass	at disk = 0, both disk and oral arm = 1, on smooth portion of oral arm = 2
85	Length of attachment to oral mass	millimeters
86	Length of scapula (smooth part)	millimeters
87	Length of scapula (mouthed part)	millimeters
88	Distribution of mouths on scapula	top = 0, bottom = 1, entire surface = 2
89	Shape of scapula	straight = 0, scimitar-shaped, curved up = 1, finger-like, curved up = 2
90	Scapulae occurrence per oral arm	one per arm = 0, two per arm = 1
91	Scapulae branched	no = 0 ; yes = 1

Table S5. Continued

No.	Description	Features states
92	Number of filaments per scapulae	count
93	Distribution of filaments on scapulae	absent = 0, scapula exterior only = 1, scapula interior only = 2
94	Shape of scapular filaments	rod-like = 0, tapering = 1, string-like = 2, string-like with terminal bulb (capitate) = 3, spatula = 4
95	Length of scapular filaments	millimeters
96	Width of scapular filaments	millimeters
97	Number of terminal clubs	count
98	Cross-sectional shape of terminal clubs	circular = 0, planar = 1, convex planar (ovoid) = 2, concave planar = 3, triangular = 4, convex triangular = 5, concave triangular = 6
99	Longitudinal-sectional shape of terminal clubs	rod-like = 0, tapering = 1, string-like = 2, string-like with terminal bulb = 3, spatula = 4
100	Length of terminal clubs	millimeters
101	Width of terminal clubs	millimeters
102	Length of the oral pillars	millimeters
103	Width of the oral pillars	millimeters
104	Depth of the oral pillars	millimeters
105	Width of the subgenital ostia	millimeters
106	Subgenital ostia with ornamentations	no = 0 ; yes = 1
107	Perradial diameter of the oral disc	millimeters
108	Depths of the oral disc	millimeters
109	Distribution of intermediate filaments on the oral arm and oral disc	absent = 0, oral arm exterior only = 1, oral arm interior only = 2, oral disk only = 3, oral arm = 4, oral arm and disk = 5
110	Number of intermediate filaments on the oral arm	count
111	Number of intermediate filaments on the oral disc	count
112	Shape of intermediate filaments	rod-like = 0, tapering = 1, string-like = 2, string-like with terminal bulb (capitate) = 3, spatula = 4
113	Length of intermediate filaments	millimeters
114	Width of intermediate filaments	millimeters
115	Number of rhopalia	count per quadrant
116	Rhopalia position	perradial only = 0, interradial only = 1, adradial only = 2, perradial + interradial = 3, perradial + adradial = 4, interradial + adradial = 5, perradial + interradial + adradial = 6
117	Rhopalia location	at umbrella margin = 0, distally on exumbrella = 1, median on subumbrella = 2, distally on subumbrella = 3
118	Rhopalium pit length	millimeters
119	Rhopalium pit width	millimeters
120	Rhopalium pit depth	millimeters
121	Number of coronal muscle folds	count
122	Coronal muscle covers radial septa or canals on proximal-distal axis	not at all = 0, partially = 1, exactly = 2, exceeds = 3
123	Coronal muscle is continuous circularly over radial septae or canals	no = 0, yes = 1, mixed depending on position = 2

Table S5. Continued

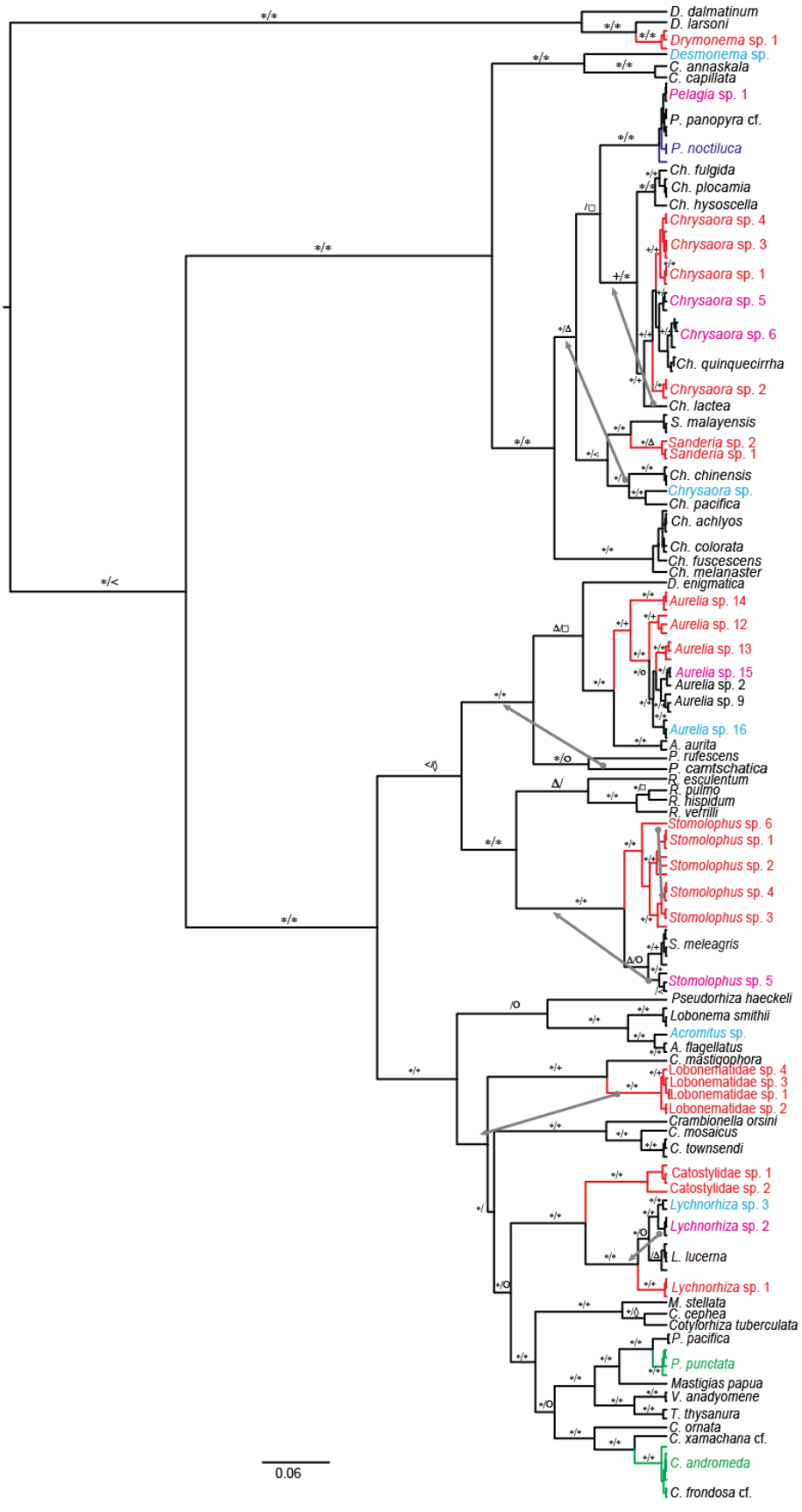
No.	Description	Features states
124	Coronal muscle pits	count per octant (averaged per centimeter band)
125	Radial muscles	absent = 0, weakly developed = 1, strongly developed = 2
126	Radial muscle distribution	subumbrellar proximal = 0, subumbrellar distal = 1, subumbrella proximal-to-distal = 2
127	Number of radial muscle folds	count per octant
128	Gastrovascular pits in radial muscle folds	count per cm of muscle
129	Number of subumbrellar sacs/sacculles	count
130	Number of rows of subumbrellar sacs/sacculles	count
131	Subumbrellar papilla width	millimeters
132	Subumbrellar papilla length	millimeters
133	Subumbrellar papilla height	millimeters
134	Subumbrellar papilla shape	dome = 0, pyramidal = 1, conic = 2, cylindrical = 3, hernia/scrotum-like = 4, wishbone = 5, horse shoe = 6, leaf = 7
135	Type of exumbrella ornamentation	none (smooth) = 0, protuberance = 1, crenulation = 2
136	Number of exumbrella ornaments	count per octant
137	Distribution of exumbrella ornaments	crown of bell = 0, toward bell margin = 1, crown and margin = 2
138	Height of protuberances (depth of crenulations)	millimeters
139	Cross-sectional shape of exumbrella ornaments	circular = 0, rectangular = 1, convex planar (ovoid) = 2, concave planar = 3, triangular = 4, convex triangular = 5, concave triangular = 6
140	Longitudinal-sectional shape of exumbrella ornaments	globose nobs = 0, tapering filaments = 1, mesa-like = 2, mound = 3, conic = 4
141	Number of pigmented flecks in perradial canal	count per quadrant
142	Number of pigmented flecks in interr radial canal	count per quadrant
143	Number of pigmented flecks in adradial canal	count per quadrant
144	Shape of pigment on exumbrella	none = 0, dot = 1, circle = 2, uneven patch = 3, radiating lines = 4, star = 5,
145	Number of pigmented spots, patches, shapes on exumbrellar surface	count per octant
146	Distribution of color spots/patches/shapes on exumbrella	crown of bell = 0, toward bell margin = 1, crown and margin = 2
147	Bell diameter	millimeters
148	Ring canal diameter	millimeters
149	Shape of the stomach/gonadal cavity	circular = 0, cruciform = 1, pouched = 2, outfolded pockets = 3, horseshoe = 4
150	Perradial diameter of the stomach cavity	millimeters
151	Structural form of gonad	digitate = 0, ribbon = 1, floret = 2, flame = 3, kidney = 4
152	Thickness of the subgenital porticus	millimeters
153	Quadralinga present	no = 0, yes = 1
154	Quadralinga length	millimeters
155	Quadralinga diameter	millimeters
156	Quadralinga shape	scooped = 0, tri-lobed = 1
157	Subumbrella radial furrows	absent = 0, present = 1
158	Number of subumbrellar radial furrows	count per octant

References

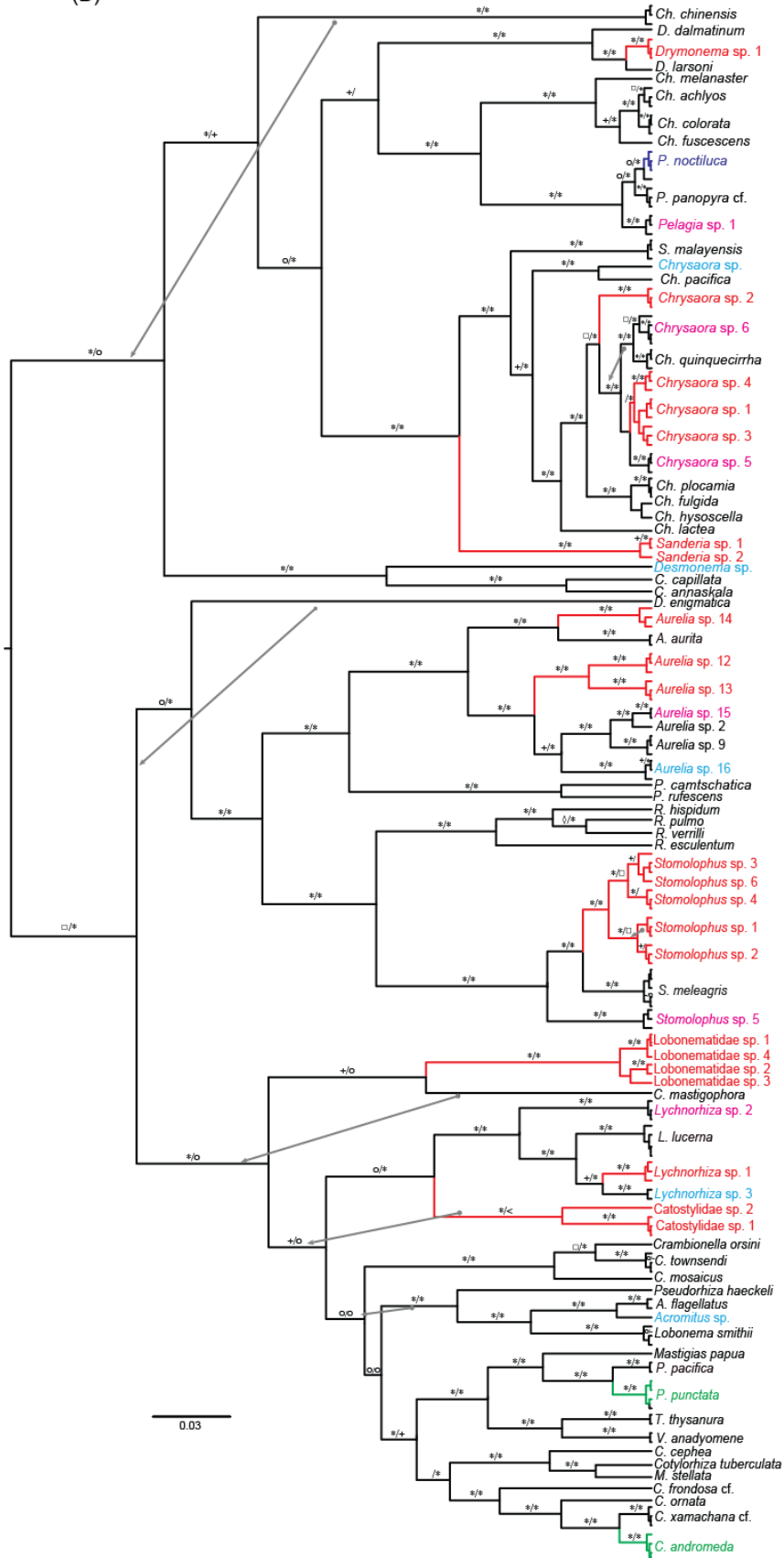
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Fig. S1. Gene-trees for 16S, 28S and 18S of 171 Discomedusae individuals, highlighting the 25 records for the TEP. (A) Midpoint rooted Bayesian 16S tree, using the TPM2uf+I+G model of evolution. (B) Midpoint rooted Bayesian 28S tree, using the TIM2+I+G model of evolution. (C) Midpoint rooted Bayesian 18S tree, using the GTR+I+G model of evolution. Geographic information on the collecting sites is provided in Table 1. Gray arrows represent alternative topologies present in the maximum likelihood analyses. Branches: black, specimens from Bayha *et al.* (2010) and additional specimens from other oceanic regions (Table S1); red, 22 new endemics from the TEP; blue, one previously recorded and correctly identified species in the TEP; green, two non-indigenous species. Leaves: magenta, five new taxa from the Caribbean Sea; cyan, four new taxa from other oceanic regions (e.g. Indo-West Pacific). Posterior probabilities and bootstrap are shown on branches: *, 100–99%; +, 98–95%; Δ, 94–90%; O, 89–85%; ◇, 84–80%; □, 79–75%; <, 74–70%; not shown if <70%.

(A)



(B)



(C)

