# Supplementary Figures and Tables

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## Supplementary Figures



**Figure S1. UCE and exon locus recovery per sample (n=96). Boxes are drawn around the 25th and 75th percentile with the median shown.**

## Supplementary Tables

**Supplementary Table 1. Collection, taxonomic identification and morphological group assignment of samples. CSIRO: The Commonwealth Scientific and Industrial Research Organisation, Australia; MCZ: Museum of Comparative Zoology, USA; MNRJ: Museu Nacional, Brazil; NIWA: The National Institute of Water and Atmospheric Research, New Zealand; USNM: Smithsonian National Museum of Natural History, USA; YPM: Yale Peabody Museum, USA.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sample # | Collection | Voucher No. | Collection year | Ocean | Latitude | Longitude | Depth (m) |
| B002 | MNRJ | 6703 | 2005 | South Atlantic | -2.255 | -38.267 | 240-260 |
| B005 | MNRJ | 4190 | 2000 | South Atlantic | -13.508 | -38.650 | 1144 |
| B006 | MNRJ | 4191 | 2000 | South Atlantic | -15.119 | -38.676 | 1012-1049 |
| B007 | MNRJ | 4212 | 2000 | South Atlantic | -19.716 | -38.534 | 922 |
| B008 | MNRJ | 4211 | 2000 | South Atlantic | -13.416 | -38.638 | 750 |
| B010A | MNRJ | 8161 | 2009 | North Atlantic | 0.436 | -17.263 | 1381 |
| B011 | MNRJ | 8165 | 2009 | North Atlantic | 0.436 | -17.060 | 893 |
| C001 | CSIRO | SS200702\_41\_43 | 2007 | South Pacific | -44.066 | 146.234 | 800-880 |
| C008 | CSIRO | SS200702\_22\_065 | 2007 | South Pacific | -44.292 | 147.067 | 1100-1300 |
| C022 | CSIRO | SS200702\_50\_019 | 2007 | South Pacific | -44.201 | 146.199 | 1050-1230 |
| C027 | CSIRO | SS200702\_025 | 2007 | South Pacific | -44.326 | 147.119 | 1100-1200 |
| C028 | CSIRO | NTM C012542/SS199701\_57 | 1997 | South Pacific | -44.175 | 146.988 | 900-1100 |
| C030 | CSIRO | SS199701\_056 | 1997 | South Pacific | -44.177 | 147.005 | 690-900 |
| C032 | CSIRO | G059214 | 2007 | South Pacific | -26.655 | 160.898 | 1474 |
| C033 | CSIRO | TT200801\_385-02 | 2008 | South Pacific | -44.244 | 147.122 | 1184 |
| C034 | CSIRO | RE2017\_C01\_VSM02\_100\_123b | 2017 | Indian | -34.798 | 131.756 | 1371 |
| C037 | CSIRO | SS199701\_057 | 1997 | South Pacific | -44.175 | 146.988 | 881 |
| C038 | CSIRO | SS200702\_028 | 2007 | South Pacific | -44.125 | 147.249 | 800-950 |
| C040 | CSIRO | RE2017\_C01\_VSM02\_100\_123b | 2017 | Indian | -34.798 | 131.756 | 1371 |
| C041 | CSIRO | TT200801\_384-07 | 2008 | South Pacific | -44.267 | 147.236 | 941 |
| C043 | CSIRO | SS0507-107-017 | 2007 | Indian | -14.817 | 121.459 | 392-407 |
| C047 | CSIRO | SS199701\_047 | 1997 | South Pacific | -44.333 | 147.110 | 1075-1361 |
| C049 | CSIRO | SS200702\_052\_067 | 2007 | South Pacific | -44.253 | 147.213 | 1240-1270 |
| C059 | CSIRO | SS199701\_057 | 1997 | South Pacific | -44.175 | 146.988 | 881 |
| C062 | CSIRO | SS199701\_040 | 1997 | South Pacific | -44.243 | 147.360 | 1024-1442 |
| C069 | CSIRO | SS199701\_056 | 1997 | South Pacific | -44.177 | 147.005 | 690-900 |
| C070 | CSIRO | SS200702\_008 | 2007 | South Pacific | -44.031 | 147.580 | 830-1030 |
| C080 | CSIRO | G59005 | 2007 | South Pacific | -28.239 | 162.627 | 1365 |
| H009 | MCZ | 45514 | 2014 | North Atlantic | 16.661 | -87.866 | 452 |
| H035 | MCZ | 46345 | 2014 | North Atlantic | 20.008 | -72.831 | 708 |
| N002 | NIWA | 126357 | 2017 | South Pacific | -35.610 | 178.854 | 1153 |
| N005 | NIWA | 41739 | 1974 | South Pacific | -30.218 | -178.533 | 610 |
| N011 | NIWA | 126364 | 2002 | South Pacific | -34.072 | 174.068 | 560-630 |
| N017 | NIWA | 86199 | 2012 | South Pacific | -30.133 | 179.769 | 573-720 |
| N022 | NIWA | 126370 | 1998 | South Pacific | -34.065 | 162.592 | 694 |
| N025 | NIWA | 126373 | 1969 | South Pacific | -37.567 | 179.367 | 1395 |
| N030 | NIWA | 126375 | 2002 | South Pacific | -34.567 | 168.783 | 870-1100 |
| N038 | NIWA | 126380 | 1999 | South Pacific | -36.505 | 176.508 | 990-1100 |
| N039 | NIWA | 83386 | 2012 | South Pacific | -37.187 | 176.978 | 930-948 |
| N040 | NIWA | 72274 | 2011 | South Pacific | -36.484 | 177.887 | 1272-1328 |
| N044 | NIWA | 82675 | 2012 | South Pacific | -36.811 | 177.465 | 878-911 |
| N045 | NIWA | 82889 | 2012 | South Pacific | -36.455 | 177.838 | 920-950 |
| N046 | NIWA | 47392 | 1999 | South Pacific | -36.506 | 176.516 | 920-1053 |
| N047 | NIWA | 65595 | 2009 | South Pacific | -33.547 | 167.745 | 691-920 |
| N048 | NIWA | 126382 | 2009 | South Pacific | -33.547 | 167.745 | 691-920 |
| N049 | NIWA | 15610 | 2004 | South Pacific | -37.209 | 177.238 | 701-910 |
| N053 | NIWA | 86193 | 2012 | South Pacific | -30.133 | 179.769 | 573-720 |
| N055 | NIWA | 64339 | 2010 | South Pacific | -34.758 | 179.431 | 750-818 |
| N057 | NIWA | 69533 | 2010 | South Pacific | -34.038 | 168.125 | 912-997 |
| N059 | NIWA | 64635 | 2010 | South Pacific | -35.415 | 178.651 | 1050-1122 |
| N062 | NIWA | 86340 | 2012 | South Pacific | -34.890 | 179.039 | 1651-1680 |
| N063 | NIWA | 65010 | 2010 | South Pacific | -35.284 | 178.863 | 1244-1276 |
| N064 | NIWA | 103473 | 2013 | South Pacific | -34.118 | 171.214 | 1060-1125 |
| N068 | NIWA | 86191 | 2012 | South Pacific | -30.133 | 179.769 | 573-720 |
| N069 | NIWA | 86212 | 2012 | South Pacific | -30.133 | 179.769 | 573-720 |
| N072 | NIWA | 105099 | 2013 | South Pacific | -33.704 | 171.729 | 837-932 |
| N074 | NIWA | 41740 | 1999 | South Pacific | -36.506 | 176.516 | 920-1053 |
| N075 | NIWA | 82559 | 2012 | South Pacific | -37.365 | 177.879 | 1229-1250 |
| N088 | NIWA | 55589 | 2009 | South Pacific | -34.830 | 173.894 | 149-151 |
| N093 | NIWA | 82673 | 2012 | South Pacific | -36.811 | 177.465 | 878-911 |
| N100 | NIWA | 94486 | 2014 | South Pacific | -40.639 | -165.553 | 1370-1448 |
| N110 | NIWA | 82433 | 2012 | South Pacific | -37.504 | 177.619 | 689-696 |
| N122 | NIWA | 83446 | 2012 | South Pacific | -37.260 | 178.016 | 1497-1540 |
| N125 | NIWA | 126403 | 2002 | South Pacific | -30.036 | -178.836 | 960-1161 |
| N133 | NIWA | 64341 | 2010 | South Pacific | -34.758 | 179.431 | 750-818 |
| N142 | NIWA | 92528 | 2002 | South Pacific | -29.968 | -178.801 | 872-1086 |
| N143 | NIWA | 83297 | 2012 | South Pacific | -37.181 | 176.983 | 998-1000 |
| N144 | NIWA | 83070 | 2012 | South Pacific | -37.475 | 176.755 | 692-699 |
| N145 | NIWA | 83385 | 2012 | South Pacific | -37.187 | 176.978 | 930-948 |
| N147 | NIWA | 16272 | 2004 | South Pacific | -36.947 | 177.335 | 1323-1346 |
| N169 | NIWA | 134653 | 2016 | South Pacific | -30.259 | -178.248 | 978-982 |
| N170 | NIWA | 125382 | 2016 | South Pacific | -31.890 | 179.321 | 1130-1320 |
| N179 | NIWA | 131039 | 2018 | South Pacific | -43.351 | 179.458 | 389-390 |
| OG07 | USNM | 1453756 | 2017 | South Pacific | -1.700 | -175.200 | 1304 |
| OG09 | USNM | 1453668 | 2017 | South Pacific | -14.470 | -168.640 | 2362 |
| OG10 | YPM | 70130 | 2005 | North Atlantic | 34.480 | -56.736 | 2103 |
| OG11 | YPM | 38587 | 2005 | North Atlantic | 38.773 | -64.088 | 1844 |
| OG12 | YPM | 38588 | 2005 | North Atlantic | 34.476 | -56.733 | 2229 |
| REM001D | CSIRO | RE2017\_C01\_VSM02\_100\_123b | 2017 | Indian | -34.798 | 131.756 | 1371 |
| S005 | USNM | 1071150 | 2004 | North Pacific | 19.801 | -156.129 | 726 |
| S013 | USNM | 1424177 | 2016 | North Pacific | 20.720 | 145.060 | 1842 |
| S022 | USNM | 1075801 | 2004 | North Pacific | 56.325 | -142.442 | 1854 |
| S054 | USNM | 1424068 | 2016 | North Pacific | 25.360 | -178.430 | 3957 |
| S055 | USNM | 1072186 | 2003 | North Pacific | 25.574 | -173.506 | 1744 |
| S057 | USNM | 1294085 | 2015 | North Pacific | 26.818 | -176.315 | 1939 |
| S080 | USNM | 59807 | 1959 | North Atlantic | 18.430 | -67.180 | 62-183 |
| S091 | USNM | 1409029 | 1986 | North Pacific | 0.245 | -91.609 | 805 |
| S139 | USNM | 1151297 | 2005 | North Atlantic | 30.802 | -79.641 | 530 |
| S151 | USNM | 1453746 | 2017 | North Pacific | 0.800 | -176.670 | 2227 |
| S153 | USNM | 1453723 | 2017 | South Pacific | -0.390 | -176.200 | 1720 |
| S155 | USNM | 1424053 | 2016 | North Pacific | 25.430 | -173.540 | 2328 |
| T010 | USNM | 1102450 | 2006 | North Pacific | 35.627 | -122.835 | 3114 |
| T060 | YPM | 38594 | 2005 | North Atlantic | 34.816 | -47.672 | 2379 |
| T061 | YPM | 38596 | 2004 | North Atlantic | 38.783 | -63.963 | 2253 |
| T062 | YPM | 38604 | 2005 | North Atlantic | 35.557 | -51.815 | 1846 |
| T065 | YPM | 38600 | 2005 | North Atlantic | 34.479 | -56.734 | 2121 |

**Supplementary Table 2. Morphology of samples including taxonomic identification and morphological group assignment. Sclerite complement of polyp and tentacle regions expressed as Versluys’ group A (“Spiculosae”), B (“Squamosae abberantes”), C (“Squamosae”). Versluys’ groups contained in brackets are those obtained from the taxonomic literature, which differ from our assignment. Asterisks indicate that the taxonomic identification of a published specimen have been revised. \* Cordeiro et al., 2015; \*\* Cairns, 2001. BB = bottlebrush; BIF = bifurcate; BF = bi-flabellate; MF = multi-flabellate; PN = pinnate; PL = planar. N/A indicated that colony form and or branching sequence could not be determined. N/A\* indicated genera for which branching sequence is not a valid character.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sample # | Colony form; Branching sequence | Versluys Group (A,B,C) | Previous identification | Type status | Current identification | Morphological Group Assignment |
| B002 | BB; 2/5R | A | *Chrysogorgia fewkesii\** |  | *Chrysogorgia* sp. 29 | *Chrysogorgia s.s.* |
| B005 | BB; 2/5R | A | *Chrysogorgia fewkesii\** |  | *Chrysogorgia* sp. 27 | *Chrysogorgia s.s.* |
| B006 | BB; 2/5R | B | *Chrysogorgia fewkesii\** |  | *Chrysogorgia* sp. 5 | Group 1 (1.0) |
| B007 | BB; 2/5R | A | *Chrysogorgia* |  | *Chrysogorgia* sp. 23 | Group 3 |
| B008 | BB; 2/5R | A | *Chrysogorgia elegans\** |  | *Chrysogorgia* sp. 22 | Group 3 |
| B010A | BB; 2/5R | A | *Chrysogorgia* |  | *Chrysogorgia* sp. 28 | *Chrysogorgia s.s.* |
| B011 | BB; 2/5R | A | *Chrysogorgia* |  | *Chrysogorgia* sp. 28 | *Chrysogorgia s.s.* |
| C001 | BB; 1/4R | B | *Chrysogorgia octagonus* |  | *Chrysogorgia octagonus* | Group 1 (1.2) |
| C008 | BB; 2/5R | B | *Chrysogorgia* sp. F |  | *Chrysogorgia* sp. 52 | Group 6 |
| C022 | BB; 1/3L | C | *Chrysogorgia cf.geniculata* |  | *Chrysogorgia* sp. 39 | Group 7 |
| C027 | BIF; N/A | B | *Chrysogorgia* sp. A |  | *Chrysogorgia antarctica* | Group 1 (1.0) |
| C028 | N/A | B | *Chrysogorgia* |  | *Chrysogorgia antarctica* | Group 1 (1.0) |
| C030 | BB; 1/3R | B | *Chrysogorgia* |  | *Chrysogorgia octagonus* | Group 1 (1.2) |
| C032 | PN; N/A | B (A: Xu et al., 2020) | *Chrysogorgia* |  | *Chrysogorgia dendritica* | Group 5 (5.2) |
| C033 | BB; 1/3L | C | *Chrysogorgia* |  | *Chrysogorgia* sp. 41 | Group 7 |
| C034 | MF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 20 | Group 1 (1.1) |
| C037 | BB; 1/4L | A | *Chrysogorgia* |  | *Chrysogorgia rotunda* | Group 2 |
| C038 | BB; 1/4L | A | *Chrysogorgia* |  | *Chrysogorgia rotunda* | Group 2 |
| C040 | MF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 20 | Group 1 (1.1) |
| C041 | BB; 1/4L | A | *Chrysogorgia* |  | *Chrysogorgia papillosa* | Group 2 |
| C043 | BB; 2/5R | A | *Chrysogorgia spiculosa* |  | *Chrysogorgia* sp. 24 | Group 3 |
| C047 | N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 6 | Group 1 (1.0) |
| C049 | BB; 1/3L | C | *Chrysogorgia* |  | *Chrysogorgia* sp. 53 | Group 6 |
| C059 | BB; 2/5R | B | *Chrysogorgia octagonus* |  | *Chrysogorgia* sp. 1 | Group 1 (1.2) |
| C062 | BIF | B | *Chrysogorgia* |  | *Chrysogorgia antarctica* | Group 1 (1.0) |
| C069 | BB; 1/4L | A | *Chrysogorgia* |  | *Chrysogorgia* sp. 45 | Group 2 |
| C070 | BB; 1/4L | A | *Chrysogorgia* |  | *Chrysogorgia papillosa* | Group 2 |
| C080 | BF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 12 | Group 1 (1.1) |
| H009 | BF; 2/5L | A | *Chrysogorgia fewkesii* |  | *Chrysogorgia* sp. 30 | *Chrysogorgia s.s.* |
| H035 | BF; 2/5L | A | *Chrysogorgia* |  | *Chrysogorgia* sp. 31 | *Chrysogorgia s.s.* |
| N002 | BF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 16 | Group 1 (1.1) |
| N005 | BF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 9 | Group 1 (1.1) |
| N011 | N/A | B | Chrysogorgiidae |  | *Chrysogorgia* sp. 48 | Group 6 |
| N017 | BB; 1/4L | A | *Chrysogorgia* |  | *Chrysogorgia* sp. 43 | Group 2 |
| N022 | BB; 1/4L | A | *Chrysogorgia* |  | *Chrysogorgia rotunda* | Group 2 |
| N025 | BB; 1/3L | B | *Chrysogorgia* |  | *Chrysogorgia orientalis* | *Dasygorgia s.s.* |
| N030 | BB; 1/4L | A | *Chrysogorgia* |  | *Chrysogorgia rotunda* | Group 2 |
| N038 | BB; 1/3L | C | *Chrysogorgia* |  | *Chrysogorgia* | Group 7 |
| N039 | BB; 1/3L | C | *Chrysogorgia* |  | *Chrysogorgia* sp. 39 | Group 7 |
| N040 | BB; 1/3L | C | *Chrysogorgia* |  | *Chrysogorgia* sp. 40 | Group 7 |
| N044 | BB; 2/5R | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 21 | Group 3 |
| N045 | BB; 1/3L | C | *Chrysogorgia* |  | *Chrysogorgia* sp. 37 | Group 7 |
| N046 | BB; 1/4R | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 2 | Group 1 (1.1) |
| N047 | BB; 1/4L | A | *Chrysogorgia* |  | *Chrysogorgia* sp. 43 | Group 2 |
| N048 | BB; 1/3L | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 49 | Group 6 |
| N049 | BB; 1/4R | B | *Chrysogorgia* |  | *Chrysogorgia octagonus* | Group 1 (1.2) |
| N053 | BB; 1/4L - 3/5L | A | *Chrysogorgia* |  | *Chrysogorgia* sp. 44 | Group 2 |
| N055 | BB; 1/4L | A | *Chrysogorgia* sp. 11-1 |  | *Chrysogorgia* sp. 43 | Group 2 |
| N057 | BB; 1/3L | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 50 | Group 6 |
| N059 | BF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 14 | Group 1 (1.1) |
| N062 | BF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 13 | Group 1 (1.1) |
| N063 | BF; N/A | B | *Chrysogorgia* sp. 11-4 |  | *Chrysogorgia* sp. 17 | Group 1 (1.0) |
| N064 | BF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 11 | Group 1 (1.1) |
| N068 | BF; 1/5R\* | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 3 | Group 1 (1.2) |
| N069 | BF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 10 | Group 1 (1.1) |
| N072 | BF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia cf. chryseis* | Group 1 (1.1) |
| N074 | BF; N/A | B | *Chrysogorgia stellata* |  | *Chrysogorgia* sp. 15 | Group 1 (1.1) |
| N075 | MF; N/A | C | *Chrysogorgia* |  | *Chrysogorgia* sp. 7 | Group 1 (1.1) |
| N088 | BB; 1/4L | B | *Chrysogorgia* |  | *Chrysogorgia comans* | *Dasygorgia s.s.* |
| N093 | MF; N/A | C | *Chrysogorgia* |  | *Chrysogorgia* sp. 19 | Group 1 (1.1) |
| N100 | BB; 1/3L - 2/7L | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 51 | Group 6 |
| N110 | BB; 2/5R | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 25 | Group 3 |
| N122 | BB; 2/5R | A | *Chrysogorgia spiculosa* |  | *Chrysogorgia* sp. 26 | Group 3 |
| N125 | BB; 1/3L | C | *Chrysogorgia* |  | *Chrysogorgia* sp. 38 | Group 7 |
| N133 | BB; 1/3L | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 4 | Group 5 (5.3) |
| N142 | PL; N/A | A | *Chrysogorgia* |  | *Chrysogorgia* sp. 31 | Group 5 (5.1) |
| N143 | PL; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 32 | Group 5 (5.1) |
| N144 | PL; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 33 | Group 5 (5.1) |
| N145 | PL; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 32 | Group 5 (5.1) |
| N147 | N/A\* | N/A\* | *Pseudochrysogorgia bellona* |  | *Pseudochrysogorgia bellona* | Outgroup |
| N169 | BB; 2/7R | B | *Chrysogorgia* |  | *Chrysogorgia expansa* | Group 1 (1.1) |
| N170 | BF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 18 | Group 1 (1.0) |
| N179 | N/A\* | N/A\* | Radicipes |  | *Radicipes* | Outgroup |
| OG07 | N/A\* | N/A\* | Iridiogorgia |  | *Iridiogorgia* | Outgroup |
| OG09 | PL; N/A | A | *Pseudochrysogorgia* |  | *Chrysogorgia* sp. 36 | Group 5 (5.3) |
| OG10 | N/A\* | N/A\* | *Metallogorgia* |  | *Metallogorgia* | Outgroup |
| OG11 | N/A\* | N/A\* | *Iridiogorgia splendens* | Paratype | *Iridiogorgia splendens* | Outgroup |
| OG12 | N/A\* | N/A\* | *Rhodaniridiogorgia fragilis* | Holotype | *Rhodaniridiogorgia fragilis* | Outgroup |
| REM001D | MF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 20 | Group 1 (1.1) |
| S005 | MF; 1/3R\* | B | *Chrysogorgia stellata* |  | *Chrysogorgia* stellata | Group 1 (1.1) |
| S013 | BB; 2/5R | C | *Chrysogorgia* |  | *Chrysogorgia campanula* | Group 6 |
| S022 | PL; N/A | A | *Chrysogorgia* |  | *Chrysogorgia* sp. 35 | Group 5 (5.3) |
| S054 | PL; N/A | A | *Chrysogorgia pinnata* |  | *Chrysogorgia pinnata* | Group 5 (5.3) |
| S055 | BB; 1/3L | C | *Chrysogorgia geniculata* |  | *Chrysogorgia* sp. 42 | Group 7 |
| S057 | BB; 1/3L | C | *Chrysogorgia* |  | *Chrysogorgia* sp. 47 | Group 6 |
| S080 | BF; 2/4L\* | A | *Chrysogorgia thyrsiformis\*\** |  | *Chrysogorgia* | *Chrysogorgia s.s.* |
| S091 | BB; 2-5L - 1/3L | B (A: Cairns, 2018) | *Chrysogorgia laevorosa* | Holotype | *Chrysogorgia laevorosa* | Group 4 |
| S139 | N/A | B | *Chrysogorgia squamata* |  | *Chrysogorgia squamata* | Group 1 (1.0) |
| S151 | PL; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 34 | Group 5 (5.2) |
| S153 | MF; N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 8 | Group 1 (1.1) |
| S155 | N/A | B | *Chrysogorgia* |  | *Chrysogorgia* sp. 46 | Group 6 |
| T010 | PL; N/A | A | *Chrysogorgia pinnata* | Holotype | *Chrysogorgia pinnata* | Group 5 (5.3) |
| T060 | BB; 3/8R | A | *Chrysogorgia averta* | Holotype | *Chrysogorgia averta* | Group 5 (5.3) |
| T061 | BB; 2/5L | B (C: Pante and Watling, 2012) | *Chrysogorgia artospira* | Holotype | *Chrysogorgia artospira* | Group 6 |
| T062 | BB; 2/5R | C | *Chrysogorgia artospira* | Paratype | *Chrysogorgia artospira* | Group 6 |
| T065 | BB; 1/3L | B (A: Pante and Watling, 2012) | *Chrysogorgia abludo* | Paratype | *Chrysogorgia abludo* | Group 5 (5.2) |

**Supplementary Table 3. Nominal species of Chrysogorgia (n=80) indicating sclerite complement of polyp and tentacle regions expressed as Versluys Group A (“*Spiculosae*”), B (“*Squamosae abberantes*”), C (“*Squamosae*”) obtained from taxonomic literature and morphological group assignment.**

|  |  |  |  |
| --- | --- | --- | --- |
| species | Versluys Group (A,B,C) | Reference | Morphological Group Assignment |
| *Chrysogorgia abludo* | A | Pante and Watling, 2012 | Group 5.2 |
| *Chrysogorgia acanthella* | C | Wright and Studer, 1889 | Group 6 |
| Versluys, 1902 |
| *Chrysogorgia admete* | B | Bayer and Stefani, 1988 | Group 1.1 |
| *Chrysogorgia affinis* | A | Versluys, 1902 | Group 3 |
| *Chrysogorgia agassizzii* | A | Wright and Studer, 1889 | *Dasygorgia s.s.* |
| Versluys, 1902 |
| B | Cairns, 2001 |
| *Chrysogorgia anastomosans* | A | Versluys, 1902 | Group 3 |
| *Chrysogorgia antarctica* | C | Cairns, 2002 | Group 1.0 |
| *Chrysogorgia arborescens* | A | Nutting, 1908 | Group 3 |
| *Chrysogorgia artospira* | C | Pante and Watling, 2012 | Group 6 |
| *Chrysogorgia aurea* | A | Kinoshita, 1913 | Group 2 |
| *Chrysogorgia averta* | A | Pante and Watling, 2012 | Group 5.3 |
| *Chrysogorgia axillaris* | C | Wright and Studer, 1889 | Group 6 |
| Versluys, 1902 |
| *Chrysogorgia binata* | C | Xu et al., 2019 | Group 1.1 |
| *Chrysogorgia bracteata* | B | Bayer and Stefani, 1988 | Group 1.1 |
| *Chrysogorgia calypso* | B | Bayer and Stefani, 1988 | Group 1.1 |
| *Chrysogorgia campanula* | C | Madsen, 1944 | Group 6 |
| *Chrysogorgia cavea* | A | Kinoshita, 1913 | Group 7 |
| *Chrysogorgia chryseis* | B | Bayer and Stefani, 1988 | Group 1.1 |
| *Chrysogorgia comans* | A | Kinoshita, 1913 | *Dasygorgia s.s.* |
| *Chrysogorgia constricta* | C | Hiles 1899 | \* |
| *Chrysogorgia cupressa* | A | Wright and Studer, 1889 | Group 2 |
| Versluys, 1902 |
| *Chrysogorgia curvata* | B | Bayer and Stefani, 1988 | Group 1\* |
| Versluys, 1902 |
| *Chrysogorgia debilis* | A | Kukenthal, 1908 | Group 4\* |
| *Chrysogorgia delicata* | A | Nutting, 1908 | Group 6 |
| *Chrysogorgia dendritica* | A | Xu et al., 2020 | Group 5.2 |
| *Chrysogorgia desbonni* | C | Versluys, 1902 | *Chrysogorgia s.s.* |
| A | Cairns, 2001 |
| *Chrysogorgia dichotoma* | A | Thomson and Henderson, 1906 | Group 2 |
| *Chrysogorgia dispersa* | A | Kukenthal, 1908 | Group 3\* |
| *Chrysogorgia electra* | B | Bayer and Stefani, 1988 | Group 1.0 |
| *Chrysogrorgia elegans* | A | Wright and Studer, 1889 | Group 3 |
| Versluys, 1902 |
| Cairns, 2001 |
| *Chrysogorgia excavata* | A | Kukenthal, 1908 | Group 1\* |
| *Chrysogrorgia expansa* | C | Wright and Studer, 1889 | Group 1.1 |
| B | Bayer and Stefani, 1988 |
| Versluys, 1902 |
| *Chrysogorgia fewkesii* | A | Cairns, 2001 | *Chrysogorgia s.s.* |
| Versluys, 1902 |
| *Chrysogorgia flavescens* | B | Nutting, 1908 | Group 6 |
| *Chrysogorgia flexilis* | A | Wright and Studer, 1889 | Group 2 |
| Versluys, 1902 |
| *Chrysogorgia flexilis var. africana* | A | Kukenthal, 1908 | Group 2 |
| *Chrysogorgia fragilis* | A | Xu et al., 2020 | Group 5.2 |
| *Chrysogorgia fruticosa* | C | Versluys, 1902 | Group 6 |
| *Chrysogorgia geniculata* | C | Wright and Studer, 1889 | Group 7 |
| Versluys, 1902 |
| *Chrysogorgia gracilis* | A | Xu et al., 2020 | \* |
| *Chrysogorgia herdendorfi* | A | Cairns, 2001 | Group 3 |
| *Chrysogorgia indica* | A | Thomson and Henderson, 1906 | Group 3 |
| *Chrysogorgia intermedia* | B | Bayer and Stefani, 1988 | Group 1 |
| Versluys, 1902 |
| *Chrysogorgia irregularis* | B | Thomson and Henderson, 1906 | Group 1.1 |
| *Chrysogorgia japonica* | C | Wright and Studer, 1889 | Group 6 |
| Versluys, 1902 |
| *Chrysogorgia laevorosa* | A | Cairns, 2018 | Group 4 |
| *Chrysogorgia lata* | A | Versluys, 1902 | Group 2 |
| *Chrysogorgia midas* | A | Cairns 2018 | Group 4 |
| *Chrysogorgia minuta* | A | Kinoshita, 1913 | *Dasygorgia s.s.* |
| *Chrysogorgia mixta* | A | Versluys, 1902 | Group 3 |
| *Chrysogorgia monticola* | A | Cairns, 2007 | Group 3 |
| *Chrysogorgia multiflora* | A | Cairns, 2001 | *Chrysogorgia s.s.* |
| *Chrysogorgia octagonos* | B | Bayer and Stefani, 1988 | Group 1.2 |
| Versluys, 1902 |
| *Chrysogorgia okinosensis* | A | Kinoshita, 1913 | Group 2 |
| *Chrysogorgia orientalis* | A | Versluys, 1902 | Group 3 |
| *Chrysogorgia papillosa* | A | Kinoshita, 1913 | Group 2 |
| *Chrysogorgia pellucida* | A | Kukenthal, 1908 | Group 2\* |
| *Chrysogorgia pendula* | C | Versluys, 1902 | Group 6 |
| *Chrysogorgia pentasticha* | A | Versluys, 1902 | Group 3 |
| *Chrysogorgia pinnata* | A | Cairns, 2007 | Group 5.3 |
| *Chrysogorgia pusilla* | A | Versluys, 1902 | Group 2 |
| *Chrysogorgia pyramidalis* | A | Kukenthal, 1908 | Group 2\* |
| *Chrysogorgia quadruplex* | A | Thomson, 1927 | *Chrysogorgia s.s.* |
| *Chrysogorgia ramificans* | A | Xu et al., 2019 | Group 3 |
| *Chrysogorgia ramosa* | C | Versluys, 1902 | Group 6 |
| *Chrysogorgia rigida* | C | Versluys, 1902 | Group 6 |
| *Chrysogorgia rotunda* | A | Kinoshita, 1913 | Group 2 |
| *Chrysogorgia scintillans* | B | Bayer and Stefani, 1988 | Group 1.1 |
| *Chrysogorgia sibogae* | C | Versluys, 1902 | Group 6 |
| *Chrysogorgia sphaerica* | A | Aurivillius, 1931 | Group 2 |
| *Chrysogorgia spiculosa* | A | Wright and Studer, 1889 | Group 3 |
| Versluys, 1902 |
| Cairns, 2001 |
| *Chrysogorgia squamata* | C | Wright and Studer, 1889 | Group 1.0 |
| Versluys, 1902 |
| B | Cairns, 2001 |
| *Chrysogorgia stellata* | B | Nutting, 1908 | Group 1.1 |
| Bayer and Stefani, 1988 |
| *Chrysogorgia tetrasticha* | A | Versluys, 1902 | Group 2 |
| *Chrysogorgia thrysiformis* | A | Cairns, 2001 | *Chrysogorgia s.s.* |
| *Chrysogorgia tricaulis* | C | Pante and Watling, 2012 | Group 6 |
| *Chrysogorgia tuberculata* | D\* | Cordiero et al., 2015 | Group 4 |
| *Chrysogorgia upsilonia* | D\* | Cordiero et al., 2015 | Group 4 |
| *Chrysogorgia versluysi* | A | Kinoshita, 1913 | Group 1.1 |

**Supplementary Table 4. Read and assembly statistics**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sample # | Total # Raw Reads | Total # Trimmed Reads | SPAdes Assembly contig length (bp) | SPAdes Assembly contig mean length (bp) | # UCE loci | # Exon loci | Total # loci |
| B002 | 10112145 | 9725903 | 77017 | 387 | 599 | 550 | 1149 |
| B005 | 2513797 | 2296434 | 42629 | 223 | 817 | 926 | 1743 |
| B006 | 2243134 | 1972046 | 30028 | 236 | 447 | 521 | 968 |
| B007 | 5130557 | 4949295 | 51559 | 293 | 683 | 807 | 1490 |
| B008 | 3871958 | 3579855 | 52073 | 199 | 849 | 984 | 1833 |
| B010A | 8940676 | 8505254 | 50437 | 332 | 941 | 1078 | 2019 |
| B011 | 4224683 | 3812658 | 47707 | 191 | 226 | 267 | 493 |
| C001 | 4185664 | 4026131 | 28803 | 501 | 967 | 1093 | 2060 |
| C008 | 8706802 | 8331116 | 33231 | 511 | 851 | 1035 | 1886 |
| C022 | 5104384 | 4832183 | 50244 | 294 | 603 | 776 | 1379 |
| C027 | 3072317 | 2963382 | 39852 | 298 | 702 | 841 | 1543 |
| C028 | 2918114 | 2802110 | 53206 | 298 | 953 | 1111 | 2064 |
| C030 | 5804152 | 5189165 | 60569 | 319 | 596 | 684 | 1280 |
| C032 | 3792583 | 3620271 | 36086 | 452 | 727 | 827 | 1554 |
| C033 | 5534157 | 5253587 | 68664 | 317 | 332 | 416 | 748 |
| C034 | 13296848 | 12617369 | 45349 | 568 | 405 | 490 | 895 |
| C037 | 4981384 | 4761808 | 63453 | 335 | 817 | 978 | 1795 |
| C038 | 7231410 | 6969881 | 44736 | 391 | 437 | 507 | 944 |
| C040 | 5215586 | 4979929 | 66292 | 455 | 947 | 1083 | 2030 |
| C041 | 7664518 | 7388881 | 32608 | 461 | 866 | 1021 | 1887 |
| C043 | 6236752 | 5937971 | 88982 | 250 | 557 | 716 | 1273 |
| C047 | 8682469 | 8147312 | 101687 | 240 | 241 | 316 | 557 |
| C049 | 5376720 | 5147940 | 32063 | 412 | 659 | 699 | 1358 |
| C059 | 7051925 | 6676361 | 50781 | 325 | 784 | 904 | 1688 |
| C062 | 9525955 | 8999904 | 43037 | 357 | 995 | 1147 | 2142 |
| C069 | 5247532 | 4854790 | 78635 | 242 | 634 | 731 | 1365 |
| C070 | 6034514 | 5667983 | 83056 | 222 | 658 | 755 | 1413 |
| C080 | 5736308 | 5481153 | 80302 | 439 | 890 | 1043 | 1933 |
| H009 | 10180783 | 9764626 | 27643 | 685 | 848 | 1008 | 1856 |
| H035 | 3862614 | 3679644 | 20642 | 649 | 838 | 995 | 1833 |
| N002 | 3480359 | 3283813 | 39343 | 468 | 803 | 957 | 1760 |
| N005 | 3986741 | 3836036 | 27680 | 358 | 975 | 1108 | 2083 |
| N011 | 4007538 | 3840729 | 25930 | 559 | 852 | 1033 | 1885 |
| N017 | 4681110 | 4477037 | 25966 | 427 | 949 | 1086 | 2035 |
| N022 | 901712 | 855523 | 21232 | 287 | 957 | 1025 | 1982 |
| N025 | 4233287 | 3827355 | 83255 | 189 | 41 | 40 | 81 |
| N030 | 2806397 | 2685498 | 30780 | 315 | 1006 | 1111 | 2117 |
| N038 | 632849 | 485511 | 6026 | 239 | 98 | 102 | 200 |
| N039 | 10002933 | 9342032 | 82855 | 356 | 462 | 569 | 1031 |
| N040 | 4993994 | 4720725 | 31006 | 522 | 758 | 897 | 1655 |
| N044 | 11857690 | 11342308 | 34089 | 506 | 909 | 1062 | 1971 |
| N045 | 6650442 | 6361475 | 25186 | 660 | 962 | 1139 | 2101 |
| N046 | 4584301 | 4416297 | 23694 | 541 | 972 | 1121 | 2093 |
| N047 | 7575996 | 7271528 | 41951 | 437 | 563 | 614 | 1177 |
| N048 | 6335288 | 6124621 | 91034 | 409 | 288 | 328 | 616 |
| N049 | 8142497 | 7783746 | 32204 | 373 | 1004 | 1162 | 2166 |
| N053 | 3983990 | 3820449 | 33444 | 454 | 834 | 957 | 1791 |
| N055 | 6458893 | 6162070 | 29234 | 622 | 912 | 1049 | 1961 |
| N057 | 8526947 | 8154792 | 32201 | 480 | 901 | 1039 | 1940 |
| N059 | 4612784 | 4398310 | 35677 | 515 | 913 | 1114 | 2027 |
| N062 | 7517157 | 7189249 | 74143 | 464 | 917 | 1072 | 1989 |
| N063 | 8000652 | 7643891 | 86237 | 492 | 905 | 1079 | 1984 |
| N064 | 4891519 | 4601029 | 41629 | 346 | 954 | 1087 | 2041 |
| N068 | 9888552 | 9317752 | 28360 | 592 | 675 | 594 | 1269 |
| N069 | 6506752 | 6184691 | 54401 | 492 | 883 | 1026 | 1909 |
| N072 | 6100156 | 5847703 | 72835 | 456 | 914 | 1087 | 2001 |
| N074 | 3364503 | 3195569 | 30323 | 386 | 656 | 743 | 1399 |
| N075 | 5217986 | 4908130 | 39514 | 474 | 879 | 1034 | 1913 |
| N088 | 12148881 | 11706919 | 34888 | 489 | 461 | 500 | 961 |
| N093 | 6255475 | 5958026 | 48294 | 458 | 734 | 884 | 1618 |
| N100 | 2861283 | 2726454 | 32826 | 492 | 860 | 1065 | 1925 |
| N110 | 6993155 | 6644857 | 29137 | 589 | 921 | 1127 | 2048 |
| N122 | 7039772 | 6698818 | 24962 | 611 | 922 | 1098 | 2020 |
| N125 | 5967015 | 5714680 | 48926 | 512 | 939 | 1105 | 2044 |
| N133 | 5897118 | 5591749 | 41556 | 494 | 832 | 938 | 1770 |
| N142 | 5911444 | 5540311 | 77785 | 273 | 896 | 1062 | 1958 |
| N143 | 4259836 | 4067095 | 26731 | 437 | 930 | 1116 | 2046 |
| N144 | 6495232 | 6181799 | 47341 | 479 | 948 | 1129 | 2077 |
| N145 | 6819112 | 6448651 | 56423 | 482 | 842 | 1041 | 1883 |
| N147 | 4489742 | 4306952 | 35685 | 492 | 758 | 871 | 1629 |
| N169 | 6602830 | 6265216 | 39866 | 490 | 958 | 1137 | 2095 |
| N170 | 6841506 | 6493690 | 44594 | 487 | 923 | 1096 | 2019 |
| N179 | 4880772 | 4644100 | 25095 | 619 | 964 | 1155 | 2119 |
| OG007 | 5298998 | 5055346 | 47905 | 513 | 991 | 1171 | 2162 |
| OG009 | 7976219 | 7571369 | 32439 | 455 | 933 | 1082 | 2015 |
| OG010 | 4838489 | 4657311 | 62748 | 396 | 976 | 1152 | 2128 |
| OG011 | 2466250 | 2366026 | 32240 | 287 | 891 | 1084 | 1975 |
| OG012 | 4428750 | 4113244 | 45267 | 307 | 536 | 612 | 1148 |
| REM001D | 6781988 | 6431889 | 50315 | 487 | 861 | 1034 | 1895 |
| S005 | 3272898 | 3097672 | 28289 | 436 | 973 | 1112 | 2085 |
| S013 | 5350931 | 5085118 | 37062 | 402 | 854 | 966 | 1820 |
| S022 | 3599819 | 3437541 | 35684 | 390 | 302 | 336 | 638 |
| S054 | 2376005 | 2243941 | 29344 | 493 | 732 | 839 | 1571 |
| S055 | 8045910 | 7636240 | 50827 | 442 | 727 | 810 | 1537 |
| S057 | 3527627 | 3370805 | 32207 | 488 | 832 | 969 | 1801 |
| S080 | 1271105 | 1109077 | 12058 | 301 | 114 | 124 | 238 |
| S091 | 4304572 | 4016145 | 129463 | 159 | 816 | 950 | 1766 |
| S139 | 2887493 | 2753983 | 25717 | 501 | 1026 | 1208 | 2234 |
| S151 | 1835893 | 1764800 | 20440 | 473 | 911 | 1091 | 2002 |
| S153 | 2903007 | 2763287 | 35059 | 475 | 903 | 1054 | 1957 |
| S155 | 5812166 | 5489046 | 28452 | 639 | 915 | 1060 | 1975 |
| T010 | 10232583 | 9774914 | 73335 | 445 | 948 | 1079 | 2027 |
| T060 | 952316 | 802273 | 11038 | 264 | 93 | 105 | 198 |
| T061 | 4532105 | 4333608 | 61140 | 272 | 736 | 905 | 1641 |
| T062 | 2045222 | 1904591 | 23684 | 296 | 953 | 1081 | 2034 |
| T065 | 2602297 | 2508082 | 46952 | 271 | 806 | 968 | 1774 |