**Supplementary material**

**Table S1.** List of hesionid and outgroup species included in the phylogenetic analysis, together with GenBank accession numbers (download)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Taxon | COI | 16S | 18S | 28S |
| *Dysponetus caecus* | AF221568 | EU555047 | AY839568 | EU555028 |
| *Nereis pelagica* | - | AY340470 | AY340438 | AY340407 |
| *Amphiduros fuscescens* | DQ442561 | DQ442569 | DQ442584 | DQ442598 |
| *Amphiduros pacificus* | JN631312 | JN631324 | JN631334 | JN631345 |
| ***Elisesione imajimai* sp. nov.** | **LC361354** | **-** | **LC361352** | **LC361353** |
| *Gyptis brunnea* | JN631313 | JN631323 | JN631335 | JN631346 |
| *Gyptis hians* | JN571824 | JN571880 | JN571891 | JN571900 |
| *Hesiolyra bergi* | GQ474434 | - | AM159577 | - |
| *Hesione* sp. | - | DQ442615 | DQ442617 | DQ442619 |
| *Hesione* cf. *picta* | - | KF006978 | KJ748004 | KF006977 |
| *Hesiospina aurantiaca* | - | JN631319 | JN631329 | JN631342 |
| *Hesiospina vestimentifera* | JN631310 | JN631320 | JN631330 | JN631343 |
| *Leocrates chinensis* | DQ442565 | DQ442575 | DQ442589 | DQ442605 |
| *Micropodarke dubia* | JN571825 | DQ442576 | JN571888 | JN571899 |
| *Neogyptis carriebowcayi* | JN631315 | JN631325 | JN631338 | JN631349 |
| *Neogyptis hinehina* | JN631317 | JN631328 | JN631340 | JN631350 |
| *Nereimyra aphroditoides* | JF3171998 | JF317211 | - | JF317204 |
| *Nereimyra punctata* | DQ442566 | DQ442577 | DQ442591 | DQ442606 |
| *Oxydromus flexuosus* | DQ442567 | DQ442578 | DQ442592 | DQ442607 |
| *Oxydromus pallidus* | - | DQ442579 | DQ442593 | DQ442608 |
| *Podarkeopsis arenicolus* | JN571827 | JN571879 | JN571889 | DQ442609 |
| *Podarkeopsis perkinsi* | JN571828 | JN571881 | JN571892 | JN571901 |
| *Psamathe fusca* | DQ513294 | DQ442581 | DQ442595 | DQ442610 |
| *Sirsoe methanicola* | DQ513295 | DQ442582 | JN631332 | DQ442611 |
| *Sirsoe sirikos* | JN571829 | JN571882 | JN571893 | JN571902 |
| *Syllidia armata* | DQ442568 | DQ442583 | DQ442596 | DQ442612 |
| *Vrijenhoekia balaenophila* | DQ513296 | DQ513301 | JN631333 | DQ513306 |
| *Vrijenhoekia ahabi* | JN571876 | JN571887 | JN571898 | JN571876 |