**Table A1 (Supplementary material)**. Dinoflagellate cyst species (or genus) found in sediment samples (paleontological names) and their corresponding dinoflagellate motile cell (thecate names).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Cysts Species (or Genus)Paleontological name** | **Dinoflagellate motile cellsBiological name** | **Autotroph (A)****Heterotroph (H)** | **4STank** | **1STank** |
| *Brigantedinium cariacoense* (Wall, 1967) | *Protoperidinium avellana* (Meunier, 1919) Balech, 1974 | H | x | x |
| *Brigantedinium simplex* (Wall, 1965) | *Protoperidinium conicoides* (Paulsen, 1905) Balech, 1973 | H | x | x |
| *Brigantedinium* sp. | *Protoperidinium* sp. | H | x | x |
| *Dubridinium* sp. | *Preperidinium* sp. | H | x | x |
| *Echinidinium karaense* (Head et al., 2001) | Unknown | H | x | x |
| *Echinidinium* sp. | Unknown | H | x | x |
| *Islandinium minutum* (Harland and Reid in Harland et al., 1981) Head et al., 2001 | *Islandinium minutum* (Head et al., 2001) Potvin et al., 2013 | H | x | x |
| *Islandinium* sp. | *Islandinium* sp. | H | x | x |
| *Islandinium minutum* var. *cezare* (de Vernal et al., 1989) Head et al., 2001 | *Islandinium* sp. | H | - | x |
| *Islandinium/Echinidinium* spp. | Unknown | H | x | x |
| *Lejeunecysta oliva* (Reid, 1977) | Unknown | H | - | x |
| *Operculodinium centrocarpum* (sensu Wall & Dale, 1966) | *Protoceratium reticulatum\** (Claparède & Lachmann, 1859) Bütschli, 1885 | A | x | x |
| *Operculodinium centrocarpum* (short spines) | *Protoceratium reticulatum\** (Claparède & Lachmann, 1859) Bütschli, 1885 | A | x | x |
| Cyst of *Pentapharsodinium dalei* (Indelicato & Loeblich, 1986) | *Pentapharsodinium dalei* (Indelicato & Loeblich, 1986) | A | - | x |
| Cyst of *Polykrikos schwartzii* (Bütschli, 1873) Matsuoka et al., 2009 | *Polykrikos schwartzii* (Bütschli, 1873) | H | x | x |
| Cyst of *Protoperidinium americanum* (Gran & Braarud, 1935) | *Protoperidinium americanum* (Gran & Braarud, 1935) | H | - | x |
| *Protoperidinium nudum* (Wall and Dale, 1968) | *Protoperidinium conicum* (Gran, 1900) Balech, 1974 | H | x | x |
| *Protoperidinium* sp. A | *Protoperidinium* sp. | H | x | x |
| *Protoperidinium stellatum* (Wall in Wall & Dale, 1968) | *Protoperidinium compressum* (Abé, 1927) Balech, 1974 | H | x | x |
| *Quinquecuspis concreta* (Matsuoka, 1985) | *Protoperidinium leonis* (Pavillard, 1916) Balech, 1974 | H | x | x |
| Cyst of *Scrippsiella lacrymosa* (Lewis, 1991) | *Scrippsiella lacrymosa* (Lewis, 1991) | A | x | x |
| Cyst of *Scrippsiella acuminata* (Braarud, 1958) | *Scrippsiella acuminata\** (Ehrenberg, 1899) Kretschmann et al., 2015 | A | x | x |
| *Selenopemphix nephroides* (Benedek, 1972) | *Protoperidinium subinerme* (Paulsen, 1904) Loeblich, 1970 | H | - | x |
| *Selenopemphix quanta* (Wall & Dale, 1968) | *Protoperidinium conicum* (Gran, 1900) Balech, 1974 | H | x | x |
| *Spiniferites belerius* (Reid, 1974) | *Gonyaulax scrippsae\** (Kofoid, 1911) | A | x | x |
| *Spiniferites* cf*.* *delicatus* | *Gonyaulax spinifera\** complex (Claparède & Lachman, 1859) Diesing, 1866  | A | x | - |
| *Spiniferites delicatus* (Reid, 1974) | *Gonyaulax spinifera\** complex (Claparède & Lachman, 1859) Diesing, 1866 | A | x | x |
| *Spiniferites elongatus* (Reid, 1974) Ellegaard et al., 2003 | *Gonyaulax elongata\** (Reid, 1974) Ellegaard et al., 2003 | A | - | x |
| *Spiniferites hyperacanthus* (Deflandre & Cookson, 1955) | *Gonyaulax whaseongensis* (Gu et al., 2021) | A | x | x |
| *Spiniferites membranaceus* (Rossignol, 1964) Sarjeant, 1970 | *Gonyaulax membranacea\** (Rossignol, 1964) Ellegaard et al., 2003 | A | x | - |
| *Spiniferites mirabilis* (Rossignol, 1964) Sarjeant, 1970  | *Gonyaulax spinifera\** complex (Claparède & Lachmann, 1859) Diesing, 1866 | A | x | x |
| *Spiniferites ramosus* (Ehrenberg, 1837) Mantell (1854) | *Gonyaulax spinifera\** complex (Claparède & Lachman, 1859) Diesing, 1866 | A | x | x |
| *Spiniferites* spp. | *Gonyaulax* sp. | A | x | x |
| *Trinovantedinium pallidifulvum* (Matsuoka, 1987) Mertens et al., 2017 | *Protoperidinium louisianensis* (Mertens et al., 2017) | H | x | x |
| *Votadinium calvum* (Wall & Dale, 1968) | *Protoperidinium oblongum\*\** (Aurivillius, 1898) Parke & Dodge, 1976 | H | x | x |
| *Votadinium spinosum* (Reid, 1977) | *Protoperidinium claudicans\*\** (Paulsen, 1907) Balech, 1974 | H | x | x |
| Unidentified (S) | Unknown |  | x | - |
| Unidentified (Round brown) | Unknown |  | x | x |
|  |  |  |  |  |
| \*Harmful or toxic species |  |  |  |  |
| \*\*Non-indigenous |  |  |  |  |

**Table A2.** Contribution (%) of dinoflagellate taxa to the dissimilarity of 4S and 1S tanks (SIMPER analysis).

|  |  |  |  |
| --- | --- | --- | --- |
| **Dinoflagellate species****(or genus)** | **Abundance (fourth root)** | **Contribution (%)** | **Cumulative contribution (%)** |
|  | **4S Tank** | **1S Tank** |  |  |
| *Brigantedinium cariacoense* | 5.27 | 3.17 | 8.29 | 8.29 |
| *Protoperidinium* sp. A | 3.23 | 1.36 | 7.34 | 15.63 |
| *Brigantedinium simplex* | 4.82 | 3.10 | 6.91 | 22.54 |
| *Islandinium/Echinidinium* spp. | 1.84 | 0.21 | 6.05 | 28.58 |
| *Dubridinium* sp. | 2.97 | 1.68 | 5.11 | 33.69 |
| *Spiniferites belerius* | 0.81 | 1.26 | 4.42 | 38.12 |
| *Scrippsiella acuminata* | 1.54 | 1.97 | 4.09 | 42.21 |
| *Echinidinium* sp. | 0.54 | 1.09 | 3.58 | 45.79 |
| *Echinidinium karaense* | 1.14 | 0.28 | 3.56 | 49.35 |
| *Spiniferites delicatus* | 0.98 | 0.48 | 3.36 | 52.71 |
| *Islandinium minutum* var. *cezare* | 1.03 | 0.25 | 3.34 | 56.05 |
| *Spiniferites mirabilis*  | 0.23 | 0.99 | 3.32 | 59.37 |
| *Protoperidinium nudum*  | 1.0 | 0.65 | 3.03 | 62.39 |
| *Spiniferites hyperacanthus* | 0.19 | 0.86 | 3.01 | 65.40 |
| *Spiniferites* spp. | 0.85 | 0.55 | 2.92 | 68.32 |
| *Selenopemphix quanta* | 0.54 | 0.79 | 2.83 | 71.15 |