NOBANIS - Marine invasive species in Nordic waters - Fact Sheet

Molgula manhattensis

Author of this species fact sheet: Kathe R. Jensen, Zoological Museum, Natural History Museum of Denmark, Universitetsparken 15, 2100 København Ø, Denmark. Phone: +45 353-21083, E-mail: krjensen@snm.ku.dk

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Species description

Species name
Molgula manhattensis, (de Kay, 1843) – sea grape (a sea squirt)

Synonyms
See taxonomic note

Common names
Lådden søpung (DK); Sea grape (UK, USA); Ronde zakpijp (NL); Meertraube (DE).

Taxonomic note
Species identification and synonymization has been very confusing for this species. For many years *Molgula manhattensis* has been considered the senior synonym of *M. tubifera* (Ørsted, 1844), *M. socialis* Alder, 1848, *M. siphonata* Alder, 1850, and *M. simplex* Alder & Hancock, 1870 (see discussion by Berrill, 1931). However, more recent studies indicate that some or all of these species may be valid separate species. It is not possible without actually examining specimens or studying descriptions in detail to determine which of the synonymized taxa occur in which localities, and there is a possibility that the true *M. manhattensis* does not occur in European waters (see e.g. Haywood & Ryland, 1995). Arenas et al. (2006) found *M. socialis*, but not *M. manhattensis* in southern England. World Register of Marine Species (WoRMS; http://www.marinespecies.org) lists 7 synonyms for *M. manhattensis*, and only *M. tubifera* is identical to the species listed above. *M. macrosiphonica* Kupffer, 1872, occurring in the western Baltic, has also been included in the synonymy of *M. manhattensis* (Lützen, 1967), but WoRMS lists it as a synonym of *M. provisionalis* Van Name, 1945, which only occurs in the western North Atlantic. Molecular studies are currently undertaken in the Netherlands to determine the true identity of *M. manhattensis*, but until the results are known, it must be assumed that the species is the one found in Nordic waters.

Identification
Almost spherical, 20-30 mm in diameter (up to 40 mm), externally covered by densely set, unbranched “hairs” and often with sand-grains, algal filaments, or shell fragments attached. The siphons are close together and relatively long, but usually contract when the animals are out of water or preserved. The atrial siphon has a squarish opening and is longer than the branchial (oral) siphon, which has 6 marginal indentations. The body color is greenish grey and, if it is not too

covered in debris, the pale pink reproductive organs may be visible through the tunic. It is often attached to man-made structures or mussels in shallow water.

For further information see e.g.,
http://wdfw.wa.gov/fish/ans/identify/html/index.php?species=molgula_manhattensis,
http://www.marlin.ac.uk/speciesfullreview.php?speciesID=3823 and
http://species-identification.org/species.php?species_group=tunicata&id=34
There are several other species of *Molgula* found in Nordic waters, e.g. *Molgula citrina* Alder & Hancock, 1848, *M. occulta* Kupffer, 1875, *M. oculata* Forbes, 1848 and *M. complanata* Alder & Hancock, 1870.

For *Molgula citrina* see: http://species-identification.org/species.php?species_group=tunicata&id=32

For *Molgula occulta* see: http://www.habitas.org.uk/marinelife/species.asp?item=ZD2570

For *Molgula oculata* see: http://www.habitas.org.uk/marinelife/species.asp?item=ZD2580 and http://species-identification.org/species.php?species_group=tunicata&id=35

For *Molgula complanata* see: http://species-identification.org/species.php?species_group=tunicata&id=33

Distribution

Native area
East coast of North America from Maine to Texas (Lützen, 1967). Some authors consider *M. manhattensis* to be cryptogenic (Jewett et al., 2005). Until synonymy has been clarified this remains unresolved.

Introduced area
In Danish fjords and brackish waters a species identified as *Molgula tubifera* (Ørsted, 1844) has been recorded since its original description from Øresund (the Sound). Later this was synonymized with *M. manhattensis* (Lützen, 1967), which has been recorded from several fjords (Rasmussen, 1973; Randløv & Riisgård, 1979). It was first recorded from Ireland in 1998 (Minchin, 2007). It is not considered introduced in Germany or Belgium (Gollasch & Nehring, 2006; Kerckhof et al., 2007). Hayward & Ryland (1995) consider *M. tubifera* and *M. manhattensis* different species, and hence claim that *M. manhattensis* does not occur in British waters. In the Netherlands *M. manhattensis/ tubifera* has been known since 1762 (Wolff, 2005) when it was illustrated, but not named, from sluice-gates. In Norway it has been found only a few places on the central west coast (Hopkins, 2001). In Sweden it is found on the west coast (Petersen & Svane, 2002), but is also included in the "alert list" (http://www.frammandearter.se/) for species not yet found in Swedish waters. No ascidians occur in the eastern and northern Baltic Sea.
Molgula manhattensis has also been introduced to the west coast of the USA where it was first found in 1984 in southern California (Lambert & Lambert, 1998).

It has also been introduced to Australia, where it was first recorded in 1967 (Hewitt et al., 2004), and it has been recorded from the southern coasts of China (Huang et al., 1993) and Japan, where the first record was from 1972 (Iwasaki, 2006).

Vector
Ballast water seems to be the most likely means of transferring this species (Gubanova, 2000), or its eggs between coastal waters of different continents. The fact that *A. tonsa* can produce highly resistant diapause eggs as well as eggs that can be induced into quiescence has probably played an important role for its wide distribution. However, it cannot be ruled out that its presence in the western North Atlantic is natural (McAlice, 1981).

Ecology

Molgula manhattensis is often associated with low salinity, e.g. in estuaries (Lambert & Lambert, 1998). This is in accordance with its occurrence in Danish waters (Lützen, 1967; Rasmussen, 1973). It may also be relatively tolerant to hypoxia, though it may delay reproduction under these circumstances (Sagasti et al., 2003). In its native area it lives in a sort of symbiosis with a fungus-like microbial organism, *Nephromyces* sp. (Saffo, 1982; Saffo & Davis, 1982). Whether this also occurs in European strains is unknown. The function of this symbiont is not fully understood but is involved in metabolism of nitrogen waste (Saffo, 1988).
Like other ascidians it is a suspension feeder and it efficiently retains particles down to 1-2 µm (Randløv & Riisgård, 1979). Filtration rate seems to be lower than for other solitary species, though the branchial basket has a more complex structure (Petersen & Svane, 2002).
It may be host for the commensal copepod *Lichomolgus albens* Thorell, 1859 (Rasmussen, 1973).

Reproduction
Ascidians are generally hermaphroditic, and this is also the case for this species. *Molgula manhattensis* has been shown to be able to self-fertilize, and although success of embryonic development was lower in a few specimens, usually normal embryos developed. Eggs are usually shed during the night and fertilized eggs develop into a tadpole larva in about 24 h (Grave, 1933). The free swimming tadpole stage last only a few days (Saffo & Davis, 1982). Sexual maturity is reached in 3 weeks, though fertility increases after one month (Grave, 1933). A free swimming larval stage may be by-passed and metamorphosis completed *in situ* (Morgan, 1942), but this may also indicate that there are cryptic species. In Danish waters *M. manhattensis* has small eggs and free swimming larvae. Reproduction begins when water temperature reaches about 10° C (Lützen, 1967). Reproductive plasticity, high fecundity and short generation time may explain the success of this species as a colonizer.

Impacts

Molgula manhattensis is part of the fouling community and has the same impacts as other fouling organisms. It has a high biodeposition rate relative to several other shallow water suspension feeders (Haven & Morales-Alamo, 1966). The state of Washington on the west coast of the USA has implemented a program to manage invasive tunicates in ports and marinas. *M. manhattensis* has been given low priority because its impacts are considered relatively minor (LeClair et al., 2009),

but it is also listed as a priority species on the “watch list” (see http://wwwtest.invasivespecies.wa.gov/documents/ANSCwatchlist.pdf).

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