Overview

Short description of *Perophora japonica*, Creeping sea squirt

*Perophora japonica* is a colonial ascidian which forms patches of small (c. 4 mm) semi-transparent, ovoid zooids (= the units of the colony) linked by slender creeping stolons. The zooids can be densely or loosely packed. Each zooid has two small siphons, and a very short stalk connecting it to the stolon. The colony has a greenish-yellow tinge, particularly in its younger parts. Bright yellow star-shaped terminal buds form in summer-autumn, especially on the colony margins.

Description of *Perophora japonica*, Creeping sea squirt status in GB

First recorded in 1999 in a Plymouth marina, *Perophora japonica* has spread only slowly to other marinas and harbours in southern Britain, but has also colonized scattered natural or semi-natural habitats, including rocky shores in SW England, the Fleet lagoon in Dorset, and various sites off the north Norfolk coast, amongst them a chalk reef.

Habitat summary: *Perophora japonica*, Creeping sea squirt

Occurs on the lower shore, in the shallow subtidal or on floating structures (e.g. pontoons), growing on a wide variety of objects: other ascidians, bryozoans, hydroids, algae, shells of molluscs, artificial surfaces, rock and stones.

Overview table

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Invasion history: *Perophora japonica*, Creeping sea squirt

Origin


First Record

First recorded in 1999 as an apparently sparse and localized population on a pontoon in Plymouth (Nishikawa et al., 2000), closely followed by an extensive population in the Fleet lagoon, Dorset in 2000 (Baldock & Bishop, 2001).

Pathway and Method

The first Atlantic occurrence, in NW France, was noted in 1982 by Monniot & Monniot (1985) and the eventual spread to SW England (Nishikawa et al., 2000) was possibly
from French populations, and via yacht traffic judging from the marina setting of the first recorded occurrence. However, subsequent spread has been relatively slow and has included widely scattered sites remote from marinas and harbours (Bishop et al., 2015), suggesting modes of dispersal other than hull fouling. A study of the mitochondrial COI gene by Perez-Portela et al. (2012) documented progressive decline in genetic diversity over time in the first-recorded British population in Plymouth. The haplotypes represented in England were a subset of those recorded in French populations.

**Species Status**

There are widely scattered populations in southern and western GB; also reported from the Channel Islands, N. Ireland and the Republic of Ireland (Minchin et al., 2016). First records in continental Europe in NW France 1982 (Monniot & Monniot, 1985), subsequently in Netherlands in 2004 (Faase, 2004). Germany (Helgoland) in 2007 (Groerl, 2012), and NW Spain in 2008 (El Nagar et al., 2010). Somewhat different-looking specimens, apparently with more than four rows of stigmata, were recorded as P. japonica in the Canaries in 2004 (Herrera et al., 2017). Within the Pacific, the species has been introduced to the west coast of North America in California (Lamber, 2005; California Department of Fish and Wildlife, 2014). Hedge & Johnston (2012) listed the species from experimental settlement panels in New South Wales, Australia in 2008 and/or 2009.

**Ecology & Habitat: Perophora japonica, Creeping sea squirt**

**Dispersal Mechanisms**

The adult colonial phase grows attached to a solid surface, and is thus potentially liable to rafting on natural or anthropogenic floating substrates, although this does not seem to have been recorded in this species. The colony releases swimming 'tadpole' larvae, which are non-feeding and thus presumed to be of short duration and limited dispersal potential. (Larvae of the native congener P. listeri settle after about 3 h (Berrill, 1950).) In P. japonica, terminal buds (or 'plaques') packed with yellow nutritive cells (trophocytes) detach from the parent colony, enabling passive dispersal followed by attachment to solid surface and development into a daughter colony (Mukai et al., 1983), representing asexual propagation away from the source colony by unknown distances.

**Reproduction**

Colony growth is by addition of zooids (the units of the colony) by vegetative budding. Detachment, dispersal and reattachment of terminal buds potentially disperses the parental genotype intact, a form of asexual reproduction. The zooids are each hermaphroditic. During sexual reproduction, eggs are retained and presumed to be fertilized by sperm obtained from the water (as shown for analogous species), then the resulting embryos are brooded by the maternal zooid and hatch as swimming larvae.

**Known Predators/Herbivores**

In GB, ascidians are consumed by various littorinimorph, pleurobranch, cephalaspidean and nudibranch gastropod molluscs, as well as some euryleptid flatworms, but it is not known if any of these eat Perophora japonica.

**Resistant Stages**

None (The deciduous terminal buds are not known to be particularly resistant to adverse conditions).

**Habitat Occupied in GB**

Occurs on the lower shore, in the shallow subtidal or on floating structures (e.g. pontoons), growing on wide variety of objects: other ascidians, bryozoans, hydroids, algae, shells of molluscs, serpulid worm tubes, artificial surfaces, rock and stones. The species was found at a depth of 24.2 m at the mouth of Carlingford Lough, Ireland (Minchin et al., 2016), but has been recorded substantially deeper, at 101 m, in Japan (Nishikawa, 1992).

**Distribution: Perophora japonica, Creeping sea squirt**

There is an overall south-westerly bias, with P. japonica now of frequent occurrence in the extreme south-west of England. Marinas and harbours or isolated pontoons in Falmouth, Fowey, Plymouth, Salcombe, Kingswear, Weymouth, Portland and Gosport. On rocky shores in Lee Bay and Woolacombe (N. Devon), Newquay, Godrey, St Ives and Gurnard (Cornwall), and near Plymouth (S. Devon). Also: sublittoral sites off Anglesey, N. Wales (L. Morris/Search at in NBN Atlas); on maerl beds (Gall, 2012) and on the shore in the Helford estuary, Cornwall; in the Fleet lagoon, Dorset, mainly on algae (Baldock & Bishop, 2001); in Poole Harbour, Dorset (L. Baldock/Search at in NBN Atlas); off north Norfolk, on a chalk reef (Spray and Watson, 2011), wrecks and a fossilised wood reef (D. Watson/Search at in NBN Atlas). A 2002 record of P. japonica from Milford Haven (Wales), included in various on-line databases, was based on a misidentification (specimen examined). The most northerly records in NE Europe are from Mutfroy Bay, Republic of Ireland (Minchin et al., 2016).
Impacts: *Perophora japonica*, Creeping sea squirt

Environmental Impact

*P. japonica* was ranked joint 35th out of 133 species non-native to the Channel Islands according to an overall threat score combining both economic and environmental considerations (Department of the Environment, States of Jersey, 2017). Nandakumar (1996) found *P. japonica* to be competitively superior to the alga *Ectocarpus sp.*, the serpulid worm *Hydroides elegans* and the bryozoan *Celleporaria aperta*, but inferior to the compound colonial ascidians *Didemnum moseleyi* and *Diplosoma mitsukurii* on sunlit settlement panels deployed in November in Tomioka Bay, southern Japan. *P. japonica* thus appeared to be of intermediate ability in competition for space, at least in winter. *Perophora japonica* has been recorded in association with sensitive habitat features such as maerl beds (Gall 2012) and chalk reefs (Spray and Watson, 2011), and for a time occupied up to 10% of available substrate area in part of the Fleet lagoon (Dorset), within the Chesil and the Fleet Special Area of Conservation (Baldock & Bishop, 2001). However, the species grows as a single layer of small zooids that are not fused to their neighbours and may be relatively well separated (although connected by slender stolons). This rather insubstantial growth habit suggests that any negative effect on the abundance and habitat occupancy of other shallow-water suspension-feeding sessile invertebrates will be relatively minor. However large, dense colonies could have an appreciable effect on pre-existing sessile communities through space occupancy, overgrowth interactions etc.

Health and Social Impact

None known.

Economic Impact

In Japan, *P. japonica* has been reported to foul Pacific oysters in cultivation (Arakawa, 1990). In the Netherlands, the species has also been reported in oyster culture facilities and on mussels (Gittenberger, 2009 and 2015). Thus, the species could potentially compete for food with commercial species or smother them, but the relatively frail growth form suggests that any effect would be relatively minor.

References & Links: *Perophora japonica*, Creeping sea squirt

Identification


Non-native species guide

https://www.mba.ac.uk/fellows/bishop-group-associate-fellow#b18 Extensive photographs http://www.aphotomarine.com/sea_squirt_perophora_japonica.html

Biology, ecology, spread, vectors


California Department of Fish and Wildlife (2014).

Introduced aquatic species in California bays and harbors, 2011 survey. Sacramento California, 1–36 pp


Hedge, L. H., & Johnston, E. L. (2012). Propagule pressure determines recruitment from...


Management and impact


General


NBN Atlas https://species.nbnatlas.org/