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Research article

Appearance of a cryptogenic tunicate, a *Didemnum* sp. fouling marina pontoons and leisure craft in Ireland

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Abstract

A colonial *Didemnum* sp. was found extensively overgrowing fouling organisms on the immersed surfaces of pontoons, ropes and chains and on the hulls of fouled pleasure craft in the Malahide Estuary to the north of Dublin in October 2005. The tunicate colonies formed pendulous growths extending ~1m on a yacht removed from the water in June 2005, but its significance at that time was not realised. A similar but less extensive cover by a *Didemnum* sp. was noted at a marina in Carlingford Lough, ~70km to the north of Malahide, in June 2006. Both sites are exposed to marine conditions on the east coast of Ireland in the Irish Sea. These forms have not been noted in Ireland before and may have recently arrived.

Key words: *Didemnum*, fouling, marina, leisure craft, Ireland, tunicate, ascidian, alien

Introduction

An unidentified *Didemnum* sp. (Tunicata: Ascidiacea, Didemnidae) was first recognised on 12 October 2005 at Malahide marina, north of Dublin on the east coast of Ireland although it was photographed on the hull of a fouled yacht in June 2005. A similar form was found at Carlingford marina, Carlingford Lough ~70km to the north and also in the Irish Sea on 28 June 2006. The growth forms of this tunicate are sufficiently different to any noticed before in Ireland by both authors with a combined diving experience of over fifty years. Within the last decade similar *Didemnum* growth forms have been reported from the north-east Pacific, New Zealand, the north-west Atlantic and more recently from France in 2001. Within Europe this growth form of *Didemnum* has been found in France in 2004 from the Rade de Brest and the harbour in Le Havre (G. Lambert pers. comm.). It has also been found in estuaries in The Netherlands (Wijman and Smaal 2006) and was found to be locally abundant in 1998 but an earlier record from 1991 is referred to (USGS 2006). Elsewhere in the North Atlantic extensive *Didemnum* growths have been found to depths of 65m on the Georges Bank off the coast of North America.

Distinction between species of this genus is difficult and many almost certainly remain undescribed. Kott (2002) determined a New Zealand form, based on morphological features, as *Didemnum vexillum* and the similar North-west Atlantic form she described as *Didemnum vestum*. In Europe *D. lahillei* has been known in the Mediterranean Sea since 1872 and is also recorded from the North Sea and the English Channel (Kott 2004). The status of the Irish form is presently unknown but it has a similar

pendulous growth form to *D. vexillum* and *V. vestum* that also overgrow other fouling biota. The extensive pendulous growth form of *Didemnum* reported here is its first known occurrence in Ireland.

Methods

Malahide marina was surveyed on 12 October 2005, 20 and 25 January 2006 and 5 July 2006. Colonies were removed by hand and by raking the sides and undersides of floating marina pontoons and boat hulls at the Malahide marina 53º26'N, 06º09'W north of Dublin. Material was also collected from mooring chains to ~750m distant from the marina. The nearest marinas to Malahide, Howth 53º23'N, 06º03'W (ca 9.5 km) and Dun Laoghaire 53º17'N, 06º08'W (ca 17 km away) were examined on 25 January 2006 and 5 July 2006. Carlingford marina, Carlingford Lough 54º02'N, 06º11'W was examined on 28 June 2006. Samples collected on 12 October 2005, and preserved in 90% ethanol, were kindly examined by Dr Gretchen Lambert, University of Washington, Seattle, to confirm the genus from features of the adult and late-larval stages. Adults in colonies have distinctive white inclusions within the colony.

Results

The massive pendulous form of *Didemnum* sp. found during October 2005 was widespread within, but confined to, the Malahide Estuary in January 2006, and a similar form was noted from Carlingford Lough in June 2006. Both sites are located on the east coast of Ireland. This growth form was not found in Dun Laoghaire or Howth marinas to the south of Malahide.

Malahide marina

The Malahide marina is situated within the Malahide Estuary that has a lagoon on its western side and a narrow shallow entrance to the sea to the east with strong tidal flow. The tidal amplitude within the estuary is ~4.0m. Depths within the marina ranged from 0.5m to ca 5m below chart datum. The substrata of the estuary vary from winnowed sands at the shallow entrance to fine muddy deposits in the shallows beneath and adjacent to the marina. Fine sediments become suspended by tidal action and wave activity.

Colonies were easily observed from the surface on the sides of marina pontoons (Figure 1). The massive growth-form was attached to fouling organisms on floating pontoon sections (Figure 2), immersed chains and ropes, buoys and on hulls of craft already burdened with fouling organisms.

Figure 1. Colonies overgrowing mussels attached to a Malahide marina pontoon, January 2006 (Photo Tom Ochman)

Figure 2. Pendulous growths of *Didemnum* sp. suspended from the underside of a marina pontoon at Malahide, January 2006 (Photo Louise Scally)

Colonies were found to have overgrown mussels *Mytilus edulis*, the solitary tunicate *Ascidiella aspersa*, and wrapped around tubes of the hydroid *Tubularia* sp. and the peacock worm *Sabella* sp. and on parts of *Fucus* sp. and *Laminaria* sp. holdfasts and stipe surfaces. Some *Sabella* tubes were completely overgrown, their remains being revealed from cross-sections of protruding growths. Filamentous algae and mobile species (amphipoda, decapoda) were not overgrown.

Colonies were frequently found as an overgrowing carpet that occupied up to several hundreds of square centimeters and from these extensive flexible pendulous growths could extend over 60cm in length. Colonies also formed flaps with narrow points of attachment (Figure 3) which were easily broken. Extensions of these colonies appeared to have the ability to grow and possibly fuse to form complex nodes. Growths from boat hulls on removal from the water formed extensions of ~1m. One yacht lifted for cleaning in June 2005 showed such growths (Figure 4) and is the earliest date for the occurrence of this *Didemnum* form in Ireland. The significance of the fouling was not realised until October.

Growths were predominantly grey to brown-yellow in colour, were firmer in texture, thicker (normally >0.5cm) than other didemnid-like and smaller-thinner and more translucent growth forms found at the other nearby marina-sites at Howth and Dun Laoghaire.

Brooded late-larval stages were present in samples from the Malahide marina on 12 October 2005 and could not be distinguished from the similar growth-forms from the north-east Pacific from British Columbia or from the north-west Atlantic New England coast (Gretchen Lambert pers. comm.).

Carlingford marina

A similar expansive non-pendulous, but lobed, pale brown-yellow coloured species was found to form local and extensive growths throughout the marina basin near Carlingford town, Carlingford Lough. These were attached beneath and to the sides of pontoons, some within 10cm of the surface. These overgrew mussels, kelp holdfasts, sponges and tubes of *Sabella* sp. The marina has a breakwater surrounding it to provide a sheltered environment in a region otherwise subject to strong tidal currents with a tidal amplitude of ~3.5m. Here colonies overgrew fouling organisms in the same way as was found in Malahide but no vacant mussel shells were found beneath colonies. None were found attached to berthed boats.

Figure 3. Colonies attached to fouling associated with a rope removed from beside a pontoon at Malahide marina, January 2006 (Photo Elizabeth Sides)

Figure 4. *Didemnum* sp. growths fouling the hull of a yacht, Malahide marina June 2005 (Photo Damien Offer)

Discussion

In the last decade some areas have noticed an increase in the numbers of non-native tunicate species (Lambert and Lambert 1998) and so it appears that some species are spreading widely in Europe such as *Styela clava* (Minchin et al. 2006a), *Botrylloides violaceus* (Streftaris et al.

2005) and *Corella eumyota* (Lambert 2004). The recent appearance in widely different world regions of the pendulous growth form of this *Didemnum* spp. is difficult to explain and it is presently unclear whether these world-wide occurrences are connected and part of the general spread of tunicates. Currently the status of the locally abundant New Zealand form is based on morphological features alone and has been given the name *D. vexillum* (Kott 2002) and the Atlantic North-American form *D. vestum* (Kott 2004).

The appearance of this *Didemnum* sp. in Ireland is remarkable on account of its massive form and possible rapid growth. Its potential to overgrow mussels could have consequences for suspended cultivation of mussels, and for some marine habitats of conservation value, should it form extensive carpet-like colonies on the continental shelf amounting to square kilometers, as has been reported on the Georges Bank (USGS 2006). The finding of this growth form, and its absence from other marina sites around the Irish coast, implies a recent arrival. The Malahide Estuary has provided a safe anchorage for leisure craft for over seventy years, but until recently it has not had a large number of moored small craft. This marina presently provides berthage for ~350 craft following construction in 2000 involving a dredger to aid in the deepening at the marina site. The former history of this craft is unknown but such a vessel might have an ability to introduce such an organism having visited different inshore and port areas. It is likely that the *Didemnum* species may have arrived either during or after this date. Clearly it was well established by June 2005 as indicated by the level of fouling on the photographed yacht hull which had been immersed and idle at Malahide marina for ~18 months. It had previously been berthed at the Howth marina.

Didemnum spp. brood larvae within the zooid cavity and are released when close to settlement. The free-living stage is generally less than hours. It is for this reason unlikely that this stage could spread unaided to the other nearby marinas or over greater distances. However, detached fragments may be dispersed by tidal and other currents and may even be spread by fishing activities.

Didemnum taxonomy requires a highly specialised expertise. The increase in massive growth forms globally has led to some new species being described (Kott 2004) and there is an urgent requirement for a review of the taxonomy of others. It is unlikely that the *Didemnum* found at Malahide and Carlingford marinas are indigenous and it is unclear whether one or more species are present. The expansion of the leisure craft industry is notable and the large available attachment surface area on immersed areas of pontoons, normally untreated with antifouling, is often greater than the nearby natural substrata (Minchin et al. 2006b). These new conditions could perhaps lead to the development of such a growth form by a native species, in which case it is difficult to explain why it has not appeared previously on boats and man-made wharfs that have been in existence for centuries, or on moorings and floating structures used for boats over many decades. Opportunities for the spread of fouling biota by small craft and ships are greater now than at any previous time. Since hulls also have relatively silt-free surfaces, and over time can develop a closer resemblance to those communities found on pontoons (Floerl and Inglis 2003) they have the capability of spreading many taxonomic groups (Minchin et al. 2006b).

Should this growth form be a non-native species it may have arrived by shipping or with small craft (ICES 2005) and probably as hull-fouling. In New Zealand its occurrence in one locality is directly associated with the movement of a barge to a sheltered inlet (Coutts 2002). Its occurrence in France from le Havre and the Rade de Brest may be associated with shipping activity. The presence at Irish sites could be explained as having arrived with hull-fouled small craft. The form can occur on leisure craft hulls, as was found in this study, and small craft could be involved with inter and intra-continental movements (Minchin et al. 2006b). Boat movements between France and Ireland are known to have taken place in 2004 and 2005 and have taken place for many years. However, its presence on hulls has been in association with other hull fouling organisms implying a possible arrival with heavily fouled craft. It has not been found to grow directly on hulls treated recently with anti-fouling paint. Carlingford Lough has shipping traffic with two commercial ports at Greenore, near its entrance, and Warrenpoint, the innermost part of the bay. Should the Carlingford population be the same species as that found in Malahide then it is very likely that there are other regions in the Irish Sea where it exists and has not yet been recorded.

If this growth form is found to be an invasive species then it is likely to appear in many other localities in Europe. Elucidating the specific

status of this form is of some importance and genetic and biochemical studies on different populations are under investigation.

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References

Coutts ADM (2002) A biosecurity investigation of a barge in the Marlborough Sounds: Cawthron Institute Report 744, 68 pp.

Floerl O and Inglis GJ (2003) Boat harbour design can exacerbate hull fouling. Austral Ecology 28: 116-127

Kott P (2002) A complex didemnid ascidian from Whangamata, New Zealand: Journal of Marine Biology Association of the United Kingdom 82(4): 625-628

Kott P (2004) A new species of *Didemnum* (Ascidiacea, Tunicata) from the Atlantic coast of North America: Zootaxa 732: 1-10

ICES (2005) Vector pathways and the spread of exotic species in the sea. ICES Co-operative Research Report No 271 25 pp

Lambert G (2004) The south temperate and Antarctic ascidian *Corella eumyota* reported in two harbours in north-west France. Journal of the Marine Biological Association of the United Kingdom 84: 239-241

Lambert CC and Lambert G (1998) Non-indigenous ascidians in southern Californian harbours and marinas. Marine Biology 130: 675-688

Minchin D, Davis MH and Davis ME (2006a) Spread of the Asian tunicate *Styela clava* Herdmann 1882 to the east and south-west coasts of Ireland. Aquatic Invasions 1(2): 91-96

Minchin D, Floerl O, Occipinti-Ambrogi A and Savini D (2006b) Small craft and the spread of exotic species. In: Davenport J & Davenport JL (eds) The Ecology of Transportation: Managing Mobility for the Environment. Kluwer Academic Publishers. Environmental Pollution 10: 99-118

Streftaris N Zenetos A and Papathanassion E (2005) Globalisation in marine ecosystems: the story of non-indigenous marine species across European seas. Oceanography and Marine Biology: An Annual Review 43: 419-433

USGS (2006) Marine nuisance species Genus *Didemnum*. http://woodshole.er.usgs.gov/project-pages/stellwagen/didemnum/ (accessed 31 August 2006)

Wijman JWM and Smaal AC (2006) Risk analysis of mussel transfer. Institute for Marine Resources and Ecosystem Studies. Ijmuden, The Netherlands. Report No. CO44/06 103 pp