



# GUIDE TO THE EXOTIC SPECIES of SAN FRANCISCO BAY

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## *Didemnum* sp. A

*Kingdom:* Animalia

*Phylum:* Chordata

*Subphylum:* Tunicata

*Class:* Ascidiacea

*Order:* Aplousobranchia

*Family:* Didemnidae

A colonial sea squirt in the genus *Didemnum*, which forms extensive, thin sheets overgrowing a variety of substrates and attached organisms, has recently been found in a number of bays and harbors on the Pacific Coast of North America. The identity of this species is not yet known. At about the same time that it appeared and spread on the Pacific Coast (during the last 10-15 years), a *Didemnum* with the same appearance and habits showed up and spread along the New England coast. A similar *Didemnum* showed up in New Zealand in 2001. All of these are similar to two species described from Europe, *Didemnum lahillei* (which has been spreading rapidly in the Netherlands in the past decade) and *Didemnum helgolander*. How many species are involved in this, and whether they are native or exotic, are matters that are being hotly debated in the community of sea squirt taxonomists—issues which will probably only be clarified (if not resolved) by molecular genetic studies. In the meantime, I will here treat the newly discovered *Didemnum* species on both North American coasts as a single exotic species, which I will refer to as *Didemnum* sp. A.

*Didemnum* sp. A has frequently been reported from bays and harbors on docks, boat hulls, ropes, pilings and other structures. In these situations the colony grows out in sheets that often grow over or fold over and fuse to other parts of themselves, forming irregular lobes that can be cylindrical and rope-like, flat, bulbous or branching and of considerable size, reaching as much as a meter in length. In New England, *Didemnum* sp. A has also been reported growing on gravelly bottom, forming encrusting mats that overgrow stones, shells and a variety of living organisms. The colonies can be tan, cream, yellow, orange or pinkish. They are most readily distinguished from other colonial sea squirts by their extensively lobed form.

The following details may be seen with a microscope and some dissection. Each colony of *Didemnum* sp. A consists of many small individuals called zooids, each

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A massively lobate colony of *Didemnum* sp. A growing on a rope at Sausalito in San Francisco Bay.



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*Didemnum* sp. A growing over a rope at Sausalito.

about a millimeter in length, embedded in the sheet-like matrix. Each zooid pumps water through its body, filtering out food particles, and along with neighboring zooids discharges the filtered water into a common space from which it exits the colony. Embedded in a thin layer in the surface of the matrix are tiny, spiny, calcareous balls, each one shaped like the head of a medieval mace.

*Didemnum* sp. A grows subtidally in bays, harbors and coastal waters, on rocks and all kinds of artificial structures, and on gravel and boulders. It has not been reported on mud or sand bottoms that lack gravel or cobbles. It has been observed overgrowing seaweeds, sponges, hydroids, anemones, limpets, oysters, mussels, scallops, barnacles, bryozoans and other species of sea squirts. In New England it is common to depths below 30 m and has been found down to 65 m. It can tolerate temperatures from -2° C to 24 ° C, and in San Francisco Bay has been collected only at salinities above 26 ppt.

*Didemnum* sp. A broods its larvae within the colony's matrix. When released, the larvae would spend a few hours in the plankton before attaching head down to a firm surface and metamorphosing into the initial zooid of a new colony. Larval settlement has been observed in summer and fall. In addition, *Didemnum* sp. A can produce new colonies through fragmentation. Lobes from a colony can break off, drift to a new site, settle or become entangled in the bottom, and grow out over the substrate.

Because it rapidly fouls and overgrows both structures and shellfish, *Didemnum* sp. A has great potential to become a significant aquaculture pest, particularly for the cultivation of mussels. It may also have a substantial impact on natural environments. In the Northwest Atlantic, it has infested a 100 square km area on Georges Bank, with coverage of 50-90% of the bottom over large parts of this area. Such coverage can smother organisms living on the bottom and in the sediment, and block the settlement of larvae.

### Similar Species

*Didemnum* sp. A differs from most types of sea squirts in having spiny, calcareous balls embedded in the surface of its matrix. Two related species on the Pacific Coast, *Didemnum carnulentum* and *Trididemnum opacum*, have similar spiny balls but these are embedded in both the surface and deeper parts of the matrix; and these species are predominantly white or gray, in contrast to the mainly tan, yellow or orange colonies of *Didemnum* sp. A.

### Native Range

Not known.

### Introduction and Distribution on the Pacific Coast [with dates of first record]

- Washington: Puget Sound [collected in 2004]
- California: Humboldt Bay [collected in 2001], Bodega Harbor [collected in 2003], Tomales Bay [collected in 2001], San Francisco Bay [collected in 1993], Half Moon Bay [collected in 1997], Elkhorn Slough [collected in 1998], Morro Bay [collected in 2000], Port San Luis [collected in 2003]

Within the bays where it has been found, *Didemnum* sp. A already seems to be



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*Didemnum* sp. A covering a bryozoan (*Watersipora subtorquata*) in San Francisco Bay.



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*Didemnum* sp. A overgrowing a bay mussel (*Mytilus trossulus-galloprovincialis*) in San Francisco Bay.



Andrew N. Cohen

*Didemnum* sp. A covering a native oyster (*Ostrea conchaphila*) in San Francisco Bay.

distributed fairly broadly. It has been collected from three sites in southern Puget Sound, at a Des Moines marina, in an underwater park at Edmonds, and on mussel aquaculture rafts in Totten Inlet. It was found at 7 sites in Humboldt Bay in 2003, and 4 sites in Bodega Harbor in 2001-2003. In San Francisco Bay, it has been collected from many sites in or near the Central Bay, from Richmond in the north to San Leandro in the south, and to nearly the mouth of the bay.

*Didemnum* sp. A. was probably introduced in hull fouling or as colony fragments in ballast water. Its larvae do not spend a long enough time in the plankton to be transported across or between oceans in ballast water.

#### Additional Global Distribution [with dates of first record]

Eastern North America [collected at Damariscotta River in Maine in 1993], in bay and coastal sites from Maine to Connecticut, on Georges Bank [2003] in the central Gulf of Maine, and on Stellwagen and Tillies banks off the coast of Massachusetts. Kott (2004) recently described this population as a species native to eastern North America, which she named *Didemnum vestum*.

It seems likely that the similar *Didemnum* species recently discovered in New Zealand will prove to be the same as *Didemnum* sp. A, although Kott (2002) has described it as a species native to New Zealand and named it *Didemnum vexillum*. It was first found in Whangamata Harbor, on the north coast of the North Island, at the end of 2001; and then on a barge and the seabed beneath it, near Picton on the north end of the South Island. It may also be present at Tauranga Harbor, on the north coast of the North Island.

#### Literature Sources and Additional Information

Coutts, A.D.M. 2002. A biosecurity investigation of a barge in the Marlborough Sounds (New Zealand). Cawthron Institute Report 744, Cawthron Institute, Nelson, New Zealand.   
<http://woodshole.er.usgs.gov/project-pages/stellwagen/didemnum/htm/page27.htm>

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Kott, P. 2004. A new species of *Didemnum* (Asciacea, Tunicata) from the Atlantic coast of North America. *Zootaxa* 732: 1-10.   
<http://woodshole.er.usgs.gov/project-pages/stellwagen/didemnum/htm/page25.htm>

#### Websites

U.S. Geological Survey - Marine Biological Invasions: *Didemnum* cf. *lahillei*   
<http://woodshole.er.usgs.gov/project-pages/stellwagen/didemnum/>



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A pendulous specimen of *Didemnum* sp. A from Bodega Harbor.



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Detail of a *Didemnum* sp. A colony from San Francisco Bay.



Luis A. Solórzano

Closeup of the surface of a *Didemnum* sp. A colony, from San Francisco Bay.



*Page Valentine & Dann Blackwood, USGS*

*Didemnum* sp. A covering gravel bottom at 47 m depth on Georges Bank in the Gulf of Maine.

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