

Great shipworm (*Teredo navalis*)



Top photo: The entire body of a shipworm. © Luis A. Solorzano.
 Bottom, from left to right: The wood-boring shell. © Hervé Bordas & Giorgio Griffon.
 Typical boreholes in wood. Weitbrecht/Wikimedia.org

The "tubes" formed when shipworms line their burrows with a chalky deposit. © Luis A. Solorzano.

Common names in English	Great shipworm. Naval (Atlantic, common) shipworm.
... and in other languages	Danish: Pæleorm. Finnish: Laivamato. German: Pfahlwurm. Holzbohrmuschel. Bohrmuschel. Bohrwurm. Schiffsbohrwurm. Schiffsbohrmuschel. Norwegian: Pelemark. Peleskjell. Swedish: Skeppsmask.
Scientific name	<i>Teredo navalis</i>
Organism group	Molluscs. Bivalves.
Size and appearance	<p>In a fully marine environment, the body of this species can grow to a length of up to 60 cm and a diameter of 1–2 cm. In the Baltic, it generally reaches about 20 cm in length, although it can be longer. The shell, on the other hand, is very small, with a length of at most 12 mm.</p> <p>A characteristic feature of boring bivalves is their greatly elongated, worm-like body, only a very small part of which is covered by a shell. The sole function of the short, gaping shell of the great shipworm is to act as a drill bit, boring circular burrows into wood. These burrows are lined with a calcareous deposit, secreted by the animal itself. To be able to drill efficiently, the animal has to be securely anchored. It presses certain parts of its body firmly against the walls of its burrow, enabling the ridged shell valves to rasp away the wood. The species prefers new wood to old, waterlogged timber. The softer the wood is (e.g. pine rather than oak), the more serious the infestation will be. Shipworms are often referred to as "termites of the sea".</p>
May be confused with	–

Geographical origin	Pacific and Indian Oceans. May possibly be cosmopolitan in warm seas.
First observed in Swedish waters	In the Skagerrak and Kattegat in the 19th century.
Occurrence in Swedish seas and coastal areas	Skagerrak and Kattegat (but see also below: "Habitat(s) in which species occurs").
Occurrence in other sea areas	Various species of shipworms, including <i>Teredo navalis</i> , occur in seas and oceans worldwide.
Probable means of introduction	<i>Teredo navalis</i> was probably spread across the seas by wooden ships hundreds of years ago. It has been present in the North Sea for a long time.
Habitat(s) in which species occurs	<p>The great shipworm lives inside wood – ships, jetties, piers and other structures that are constantly submerged in sea water. It lives at whatever depth its "home" (the wooden structure in question) happens to be, which may be anywhere from the water surface down to considerable depths. It reproduces best in warmer waters, but is also successful in colder seas. Living inside timber as it does, <i>Teredo navalis</i> is protected from predators.</p> <p>Unlike other boring bivalves, <i>T. navalis</i> feeds almost exclusively on wood (sugar molecules in the cellulose). However, it also filters plankton from the water by means of a siphon, which protrudes through a hole in the wood and sucks in water (and with it oxygen and plankton).</p> <p><i>Teredo navalis</i> has been regarded as a marine species, requiring relatively high salinity, and up to now the Baltic Sea has therefore been considered safe from its attentions. However, there is documentary evidence of the species having occurred around Warnemünde on the Baltic coast of Germany as early as 1875. Along the westernmost stretches of that coast, it has reproduced periodically, in 2- to 3-year spells, over the last 50 years or so, but viable populations have never arisen. The great shipworm's failure to make serious inroads into the Baltic is the most important reason why large wooden ships have been found in such good condition after centuries on the seabed.</p> <p>Now, though, over a hundred shipwrecks infested with the species have been found in the southern Baltic, from the entrance to the Baltic to Arkona on the island of Rügen. No one knows for sure what has changed to allow this shipworm to become established here: has the water become more saline, has the species modified its habitat requirements, or have shipworms from other sea areas hitched a ride into the Baltic in the ballast water of ships? It may be that the limiting factor for <i>T. navalis</i> is not in fact salinity, but water temperature, and if so even a small rise in temperature (and salinity) could open up the Baltic as a habitat for the species. German scientists have speculated that a combination of warmer summers (resulting in warmer sea water), milder winters and higher nutrient inputs to the water (eutrophication) may have played a part in enabling the species to establish itself in the Baltic and begin to cause damage there.</p>
Ecological effects	Shipworms are of major ecological significance, in that they break down organic material in the sea that has originated on land. This is particularly important in tropical regions with mangroves, where the large quantities of organic matter accumulating would otherwise take much longer to decompose.

<p>Other effects</p>	<p>The great shipworm causes extensive and costly damage to unprotected and untreated timber structures. Wood that is attacked is damaged beyond repair by the many burrows bored into it. The hulls of wooden ships used to be protected with copper sheathing and, before that, with tar. There are reports that the species may have developed a resistance to anti-fouling agents such as creosote.</p> <p>Examples of damage and costs attributable to <i>Teredo navalis</i>:</p> <ul style="list-style-type: none"> • From the Netherlands there were reports in 1731 of a "horrible plague" of shipworms that destroyed the dykes protecting the lowlands from the sea. According to the documents, the dykes collapsed, resulting in flooding. • Between 1919 and 1921 (see images at USGS), a succession of wharves, piers and ferry slips in San Francisco Bay collapsed following infestation with <i>T. navalis</i> (see "Additional information"). The destruction was extensive and costly. Varying figures have been put on the final bill, from \$500–900 million, through \$2–3 billion, to possibly as much as \$20 billion, all at today's prices. • According to the German authorities, almost €10 million of damage was done to wooden structures along the coast of Mecklenburg-West Pomerania over a five-year period in the 1990s.
<p>Additional information</p>	<p>The scientific name <i>Teredo navalis</i> comes from <i>teredo</i> = wood-gnawing worm (<i>terebro</i> = drill) and <i>navalis</i> = of ships or the sea.</p> <p>There are conflicting reports concerning the use of the common German name <i>Schiffsbohrwurm</i> ("ship-boring worm"). According to some sources, the name is used, not for <i>T. navalis</i>, but for the related species <i>Psiloteredo megotara</i> (previously known as <i>Teredo megotara</i>). However, <i>Schiffsbohrwurm</i> is frequently given as the common name for <i>T. navalis</i>.</p> <p>On the Pacific coast of America, people already had bitter experience of the Pacific shipworm (<i>Bankia setacea</i>), a species requiring high salinity that had caused considerable damage along the coast. For this reason San Francisco Bay, with its brackish water, was chosen as the site for a new shipyard that would be "safe from attack by wind, wave, enemies, and marine worms". And then the Atlantic species <i>Teredo navalis</i> arrived. It was discovered in the Bay in 1913, and within a few years disaster had struck (see above).</p>
<p style="text-align: center;"><i>FIND OUT MORE</i></p> <ul style="list-style-type: none"> • Baltic Sea Alien Species Database: <i>Teredo navalis</i> http://www.ku.lt/nemo/directory_details.php?sp_name=Teredo+navalis • Coastal Research & Management (CRM): <i>Teredo navalis</i> – the shipworm http://wp1001072.wp002.webpack.hosteuropa.de/crm_mambo/crm_mambo_english/index.php/content/view/25/47/ •  8,7 MB: Bundesanstalt für Gewässerkunde: Neozoa (Makrozoobenthos) an der deutschen Nordseeküste: Eine Übersicht. http://www.stefannehring.de/downloads/083_Nehring+Leuchs-1999_BfG-Bericht-1200_neozoa-nordsee.pdf • Fouling Atlas Project (Bewuchs-Atlas-Projekt): <i>Teredo navalis</i> http://www.bewuchs-atlas.de/index.php?option=com_content&task=view&id=84&Itemid=59&orgtsn=81862 •  3,4 MB: Nationaal Natuurhistorisch Museum: Non-indigenous marine and estuarine species in The Netherlands: <i>Teredo navalis</i> http://www.marbee.fmns.rug.nl/pdf/marbee/2005-Wolf-ZoolMed.pdf • Marine and estuarine invertebrates native to The Netherlands: <i>Teredo navalis</i> http://home.hetnet.nl/~fassema/Teredonavalis.html • Royal Netherlands Institute for Sea Research: Paalworm http://www.nioz.nl/vleet/content/ned/index.php?use_template=vleet_template.html&item=vleet&pageid=NED0529.HTM#0594 • Projektet Monitoring, Safeguarding and Visualising North European Shipwreck Sites (MOSS) http://www.nba.fi/INTERNAT/MoSS/ger/darsser_5.html 	

- North European and Baltic Network on Invasive Alien Species: *Teredo navalis*
<http://www.nobanis.org/speciesInfo.asp?taxaID=254>
- Marine Field Guide of the South East Pacific, The Antarctic Peninsula, Kamchatka & the Baltic Sea: *Teredo navalis*
<http://www.guiamarina.com/balticsea/03%20Animals/05%20Mollusca/Bivalvia/Teredo%20navalis.htm>
- ANS (Aquatic Nuisance Species) Task Force: A Case Study of the Biological Invasions of the San Francisco Bay and Delta
<http://www.anstaskforce.gov/Documents/sfinvade.htm>
-  112 kB San Francisco Estuary Institute: Exotic organisms
[http://www.sfei.org/bioinvasions/Reports/1999-Exotic Organisms.pdf](http://www.sfei.org/bioinvasions/Reports/1999-Exotic%20Organisms.pdf)
- US Geological Survey (USGS): The history and effects of exotic species in San Francisco Bay
http://sfbay.wr.usgs.gov/benthic_eco/exotic_species/what_shipworm.html
- Marine Life Information Network for Britain & Ireland (MarLIN): *Teredo navalis*
<http://www.marlin.ac.uk/species/Teredonavalis.htm>
- California Biota Website: Shipworm *Teredo navalis*
<http://www.californiabiota.com/cabiota/shipworm.htm>
- Liceo M. Foscarini: Conchiglie Veneziane: *Teredo cfr. navalis* Linneo, 1758
<http://www.liceofoscarini.it/didattic/conchiglie/bivalvi/specie/TeredoNavalis.htm>
- National Introduced Marine Pest Information System (NIMPIS): Naval shipworm
<http://www.marine.csiro.au/crimp/nimpis/spSummary.asp?txa=10036>

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<http://www.californiabiota.com/>
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<http://www.liceofoscarini.it/didattic/conchiglie/bivalvi/specie/TeredoNavalis.htm>

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http://commons.wikimedia.org/wiki/Teredo_navalis

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