Recognizing and Controlling Marine Wood Borers

Oregon State University
Extension Marine Advisory Program
A Land Grant / Sea Grant Cooperative
SG 49 March 1979

Properly preserved, wood can withstand the ocean's harsh environment for decades; unprotected, wood cannot withstand wood-destroying organisms, which can reduce it to fragments.

Marine borers, wood-rotting fungi, and certain insects cause more than $500 million in damages to wooden waterfront structures each year in the United States alone. Above the waterline, fungi and insects exact their toll. Below the marine waterline, wood-boring animals, including gribbles, shipworms, and pholads, have been a menace since wooden vessels first ventured onto the seas, thousands of years ago.

Although mariners class them as enemies, these organisms do play an important role in recycling driftwood back into nature's renewal scheme.

Fortunately for Pacific Northwest residents, properly treating wood with creosote provides excellent protection above and below the waterline. Forty years' or more service from creosoted piling is not uncommon.

Unfortunately, creosote alone is not always adequate from San Francisco south, where other single- and more expensive dual-preservative treatments may be required to protect wood from the gribble, *Limnoria tripunctata*. This gribble has been found in some Pacific Northwest localities, but it does not seem to attack creosoted wood here.

In Oregon, low-cost, untreated pilings often are used in low-salinity estuaries, normally free of marine borers. Rot fungi and insects, which attack above the water line (and which must have air to function), can destroy the usefulness of such pilings within 12 years. Below the waterline, these piles will remain sound indefinitely.

If, however, salinity conditions change, such as during long periods of low rainfall, marine borers can move upstream along with the saltwater and shorten this serviceable life to a few years or less.

Shipworms can rapidly riddle the interior of unprotected wood piles with holes; destruction by gribbles is generally slower—it may take 5 or more years of constant surface attack.

Pholads, found principally in tropical waters, can be very destructive.

This bulletin was prepared by Guy G. Helsing, Research Assistant, Department of Forest Products, Oregon State University.

The **shipworm** is a clam-related animal that bores deeply into wood by means of a pair of finely serrated shells at its head with which it rasps away the wood. As the shipworm grows, its tunnel increases in diameter and length while the entrance hole remains about the same size. At the entrance hole, a pair of siphons permit seawater to enter, carrying dissolved oxygen into the body and discharging waste and reproductive products into the sea.

When danger threatens, the shipworm retracts its siphons and plugs the hole with hard structures on the siphons, called *pallets*. Piles attacked by shipworms appear misleadingly sound on the surface; yet, on the interior, they may be completely riddled with a maze of tunnels. Shipworms spread by tiny larvae, or young, carried by currents.

The **gribble** is a tiny but destructive crab-related creature that burrows just below the wood surface. As waves and debris wear away the weakened wood, this borer digs deeper for protection and food, but it is also free to swim from infected pile to sound pile through seawater. Collectively, thousands of gribbles can narrow the diameter of a pile at the rate of about 1 inch (or 25 mm) a year.

In general, this rate is faster in warm, tropical waters and slower in colder waters. Eventually, a heavily attacked pile takes on the characteristic "hourglass" shape.

The rock-burrowing **pholad** also burrows into wood, causing considerable damage to piling in Hawaii and Mexico. This borer is related to the shipworm but resembles an ordinary clam, for its body is entirely enclosed within a pair of shells. Like the shipworm, it is also captive to its tunnel.

To prevent attack by marine wood borers, your wood must be properly pressure-treated. Generally, this means you must have the work done by a commercial treating plant, equipped with chambers in which preservatives can be applied to wood under high pressure and temperature. Such plants work to meet standards set by the American Wood-Preservers' Association. The type of preservatives the plant will use depends largely on the type of borers present in your area. You should be able to specify which organisms you want the wood protected against for your intended use of the wood.

Wood preservatives for marine use include creosote, creosote-coal tar, and waterborne salts.

Creosote is used widely where its black color and odor are not objectionable and where painting is not necessary. Creosote-coal tar has similar characteristics but is a thicker solution, which helps reduce checking and mechanical wear of treated wood.

Waterborne preservatives undergo chemical changes within wood, making them resistant to leaching. Wood treated with these preservatives is green in color, odorless, clean, and can be painted when dry. This treatment is required where *Limnora tripunctata* are present, but use it in combination with creosote (dual treatment) if pholads are also present. The two marine-grade waterborne preservatives are ammoniacal copper arsenate (ACA) and copper chrome arsenate (CCA).

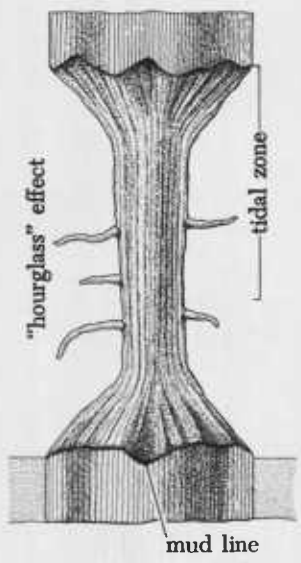
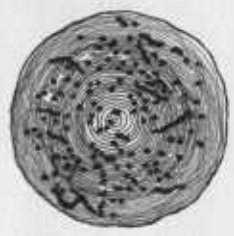
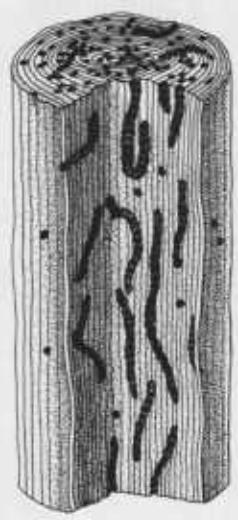
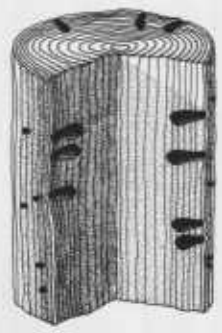
Pentachlorophenol is an excellent, widely used preservative for preventing attack by rot fungi and insects, but it is ineffective against marine borers.

Whichever wood preservative fits your need, take precautions to help insure a long service life:

- Predrill holes and make cuts before pressure treatment if possible.
- Avoid making holes or cuts below the water line.
- Treat all holes and cuts made after pressure treatment.
- Protect cutoff pile tops at once by applying a preservative and capping to shed water. Don't "slope" pile cutoffs.
- Bolt narrow treated planks together to make a larger timber instead of using one member that may open seasoning checks and decay inside.
- Make a saw kerf to the center of large timbers prior to pressure treatment to help control checking and prevent internal decay.
- See the slide tape, *Improving the Performance of Wood in Waterfront Structures* ("For further information," below), for more details.

Table 1 (on the other side of this sheet) illustrates some of the more prominent, characteristic features of the major marine borers; shows what preservative treatments are required for various service conditions; and suggests means of stopping borer attack. The success of methods for stopping borer attack is largely determined by the amount of sound wood that remains.

Table 1.—*The major marine borers: characteristic features, preservative treatments, means of stopping their attacks*

Popular and generic names	Appearance	Geographical distribution	Wood-damage characteristics		To detect presence	To prevent attack[a]	To stop attack
Gribbles							
Limnoria lignorum (Rathke)	⅛ to ¼ inch (3 to 6 mm) long; no tubercles. 	Found principally in cold waters of North America, generally north of San Francisco Bay.	 ¼- to ½-inch (6- to 12-mm) deep burrows	Attacks untreated wood	At low tide, check wood for thinning, accompanied by a network of interlacing tunnels, each 1/6 inch (1.5 mm) in diameter, usually not deeper than ¼ inch (12 mm).	1. 20 to 25 lbs of marine-grade creosote or creosote-coal tar per cubic foot of wood. *or* 2. 2.5 lbs of ACA or CCA per cubic foot of wood.	
Limnoria quadripunctata Holthuis	⅛ to ¼ inch (3 to 6 mm) long; 4 tubercles. 	Inhabits temperate water.		Attacks untreated wood			
Limnoria tripunctata Menzies	⅛ to ¼ inch (3 to 6 mm) long; 3 tubercles. 	San Francisco Bay and south, but it has been reported as far north as the Straits of Georgia. Highest population in tropical waters.		Attacks untreated and creosoted wood		1. Dual treatment.[b] *or* 2. 2.5 lbs of ACA or CCA per cubic foot of wood.	
Shipworms							
Teredo navalis Linné	Adults can grow 1 to 2 feet (30.5 to 70 cm) long; ½-inch (12-mm) diameter. 	Warm seawater, San Francisco Bay and south, but also in some British Columbia localities. Can withstand lowest salinity of all borers, reportedly as low as 5 parts per 1000 (seawater is 30 to 35 parts per 1000).		Usually, little external evidence can be found to indicate shipworm attack. Entrance holes remain 1/16 inch (1.5 mm) or less in diameter while this clam's body enlarges as it enlarges its burrow.	1. Sounding devices used by divers can detect damage in 25% increments. 2. Immerse untreated wood test panels and cut up at monthly intervals to see if borers are present. Remember: wood floats, so attach a sinker.	1. 20 to 25 lbs of marine-grade creosote or creosote-coal tar per cubic foot of wood. *or* 2. 2.5 lbs of ACA or CCA per cubic foot of wood.	1. Wrap pile with plastic well below mud line to above tidal range to kill existing borers by eliminating their oxygen supply and prevent others from attacking. *OR* 2. Reinforce pile with a concrete jacket.
Bankia setacea Tryon	Adults can grow 5 to 6 feet (1.5 to 1.8 m) long; ⅞-inch (22-mm) diameter.	The major shipworm north of San Francisco. Much more sensitive to salinity changes than *Teredo*, so many northern estuaries are free of shipworm attack in their upper reaches.					
Pholads							
Martesia striata Linné	2 to 2½ inches (50 to 63 mm) long; 1-inch (25.4-mm) diameter 	Inhabits tropical waters; a severe problem in both untreated and inadequately treated wood in Hawaii and off the Mexican coastline. They also burrow into rock.	 Unlike the shipworm's, the size of the entrance hole increases to about ¼ inch (6 mm), making it possible to notice their presence.	1. Look for entrance holes. 2. Sounding devices used by divers can detect damage before the item is destroyed.	1. 20 to 25 lbs of marine-grade creosote or crcosote-coal tar per cubic foot of wood. *or* 2. Dual treatment.[b]		

DRAWINGS BY DONNA KLENTZ

[a] Consult Federal Specification TT-W-571 and corresponding American Wood-Preservers' Association standards C3 and C18 for specific information on treatment. Federal specifications are available for a nominal fee from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Obtain AWPA standards from American Wood-Preservers' Association, Suite 444, 7735 Old Georgetown Rd., Bethesda, Maryland 20014.

[b] Dual treatment: Treat pilings with 1.0 to 1.5 lbs of ammoniacal copper arsenate (ACA) or copper chrome arsenate (CCA) per cubic foot of wood; dry; and treat with 20 lbs of creosote or creosote-coal tar per cubic foot of wood.

For further information

Advice about pressure-treated wood

American Wood Preservers Institute
1651 Old Meadow Rd.
McLean, Virginia 22101
(703) 893-4005
1031 Yeon Bldg.
Portland, Oregon 97204
(503) 227-7877

Printed materials

Bramhall, G., *Marine Borers and Wooden Piling in British Columbia Waters*, Department of Forestry Publication 1138 (Victoria, 1966).

Hill, C. L., and C. A. Kofoid, *Marine Borers and Their Relations to Marine Construction of the Pacific Coast: Final Report of the San Francisco Bay Marine Piling Committee* (Berkeley: University of California Press, 1927). Out of print but well worth the search.

Marine Biology Operational Handbook—Inspection, Repair and Preservation of Waterfront Structures, U.S. Navy, Bureau of Yards and Docks Publication NAVDOCKS MO-311 (Washington, 1965).

Nicholas, D. D., *Wood Deterioration and Its Prevention by Preservative Treatment*, 2 vols. (Syracuse, N.Y.: Syracuse University Press, 1973).

Ray, Dixy Lee, *Marine Boring and Fouling Organisms* (Seattle: University of Washington Press, 1959).

Walden, C. C., and P. C. Trussell, "Sonic Examination of Marine Piles," *The Dock and Harbour Authority*, 46 (1965): 535.

Films

Both films are available (no rental fee) from Navy Facilities Engineering Command, 200 Stovall St., Alexandria, VA 22332, Attn.: Applied Biology Section.

Wood Preservation—Inspection for Wood Destroying Organisms (20 min), U.S. Navy No. MN-8167a. Decay and insect attack in Navy structures.

Wood Preservation—Control of Wood Destroying Organisms (22 min), U.S. Navy No. MN-8167b. Training film on control measures in Navy structures.

Slide tapes

Both sets are available from Forestry Media Center, c/o Business Office, School of Forestry, Oregon State University, Corvallis, OR 97331 (rental $12, purchase $70). Oregon residents may borrow either set (no rental fee) from Extension Marine Agent Paul Heikkila, Coos County Extension Office, 290 N. Central, Coquille, OR 97423.

Wood Destroyers in the Marine Environment (75 slides, 15 min). Describes the organisms involved in marine wood deterioration, the nature of their attack on wood, and the conditions that favor their development.

Improving the Performance of Wood in Waterfront Structures (77 slides, 15 min). Prescribes proper design and construction techniques to obtain good serviceability of wood in a harsh environment.

OREGON STATE UNIVERSITY
EXTENSION SERVICE

Extension Service, Oregon State University, Corvallis, Henry A. Wadsworth, director. This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties. Extension's Marine Advisory Program is supported in part by the Sea Grant Program, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Extension invites participation in its activities and offers them equally to all people, without discrimination. 3-79/XX