



drawing by R.D. Turner, Ph.D.

Marine Borers - Biodeterioration

- *Fouling* organism refers to any marine life living in an area that interferes with human activities.
- Common marine foulers include barnacles, algae, shellfish, tunicates, shipworms, gribbles etc.
- Damage from shipworms is an old problem. It is believed that the Spanish Armada of 1643 was destroyed in a storm because the hulls of the ships were badly damaged by these organisms.
- Woods Hole Oceanographic Institution (WHOI) was funded by the US Navy during World War II to develop effective controls to marine fouling. It was estimated that up to 1/3 of the fuel used by war ships could be saved if fouling was eliminated. WHOI pioneered the use of compounds containing heavy metal bottom paints (lead, copper etc.). These chemical preparations worked very well acting as general "biocides".
- Later research has shown these heavy metal compounds to be hazardous to all life in the sea, especially in shallow bays and harbors. Less toxic and more species specific controls were needed as use of heavy metals was regulated.
- TBTO (tributyltin-oxide) a heavy metal antifouling compound is one of the most toxic chemicals used in the marine environment.
- Biologists like Dr. Ruth Turner (world expert on marine borers - shipworms, etc.), realized the need to fully understand the life cycles of so-called *fouling* organisms in order to design effective, environmentally friendly controls.

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- Dr. Turner's research centered around the prevention of the settling of shipworm larvae to prevent attack on new wood. The most vulnerable part of the shipworm's life cycle is its larval stage. Effective control measures include, treating wooden structures (lobster traps etc.) in a hypersaline solution and wrapping pilings with plastic. These methods stop settling and do not harm the marine environment. The other important factor is to eliminate scrap wood from harbors.
- The last major borer attack on the US coastline occurred in the early 1920's. The most destructive attack came at San Francisco in 1924. The harbor was frequented by wooden ships sailing up from southern waters with marine borers living in their hulls. Many wooden sailing ships lay abandoned in the harbor in this new age of steam ships, this ready source of scrap wood caused an explosion in the borer population. To compound matters the city of San Francisco was expanding and drawing more and more water out of the local rivers that ran into the bay, this caused salt water to penetrate up river and the borers came along undermining and destroying hundreds of structures, causing millions in damages. Major new work was begun on these organisms after this attack.
- Since the major marine borer attack of the 1920's, pollution in US harbors have kept their populations in check. In the 1970's the slow clean up of pollution began with the implementation of the Clean Water Act. New York harbor in particular has had a dramatic drop pollution levels and as a result the borers have returned. Most marine structures built in the last half century in NY were built with no protection against borers, millions of dollars in damage has occurred and remediation efforts will cost millions more. Boston harbor marine structures will suffer a similar fate as our water quality is improved with a new sewage treatment plant that reduces pollution in the inner harbor. Alternate mechanisms that control marine borer populations will need to be implemented.
- Marine borers (shipworms) are worldwide. Foulers are often transported great distances on the bottoms of ships or other floating wood to which they are attached.
- Shipworms are the termites of the sea, responsible for recycling most of the wood that enters the world's oceans from rivers etc. Without these organisms wood would take a very long time to decompose and all inshore areas would be clogged with wooden debris.
- In the late 1970's a nuclear power plant was constructed on Oyster Creek near Barnegett Bay, New Jersey. Thermal pollution from the water used to cool the plant raised the temperature of the bay high enough to allow marine borers arriving in the hull of ships returning from southern waters to survive the winter in New Jersey. The borer population increased dramatically and caused extensive damage at local marinas. Boats sank and docks fell into the creek. Dr. Turner studied the problem and was able to determine that the power plant was responsible.