

SEA WATER PILING: TRADITIONAL OR ALTERNATIVE MATERIALS? AN INTEGRATED BIOLOGICAL AND ECOTOXICOLOGICAL EVALUATION IN VENICE LAGOON (ITALY)

A. Volpi Ghirardini ¹, C. Losso ¹, G. Libralato ^{1*}, M. Zanella ¹, E. Keppel ², M. Sigovini ² and D. Tagliapietra ²
¹ Environmental Sciences Department, University of Venice, Campo della Celestia 2737/b, 30122, Venice, Italy - giovanni.libralato@unive.it

² Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine, Riva Sette Martiri, 1364/a, I-30122 Venice, Italy

Abstract

Wood has been traditionally used as piling material in estuarine and marine coastlines. Recently, in Venice lagoon, timbers turn-over accelerated not only due to water mechanical action, but also to the increase of their biological degradation operated by wood borers. The need to guarantee navigation safety and increase environment protection determined the identification of a series of traditional add-ins and alternative piling materials. The aim of this study was to verify through some *in situ* and *ex situ* experiments the ecotoxicological viability of the proposed piling materials as well as to fill the gaps in the knowledge about the distribution and ecology of the main species of wood boring invertebrates in order to supply policymakers and stakeholders with a series of scientific criteria to manage the timbers turn-over phenomenon.

Keywords: *Bio-Accumulation, Ecotoxicology, Lagoons*

Large amounts of wood have been used over the centuries for piles, docks and bulkheads for developing estuarine and coastal areas. Wood is a particularly useful building material as it is a renewable resource, with relatively low harvesting costs and excellent strength-to-weight properties [1]. Timbers for piling purposes are frequently treated in order to retard or prevent decay due to wood-boring organisms such as fungi, molluscs and crustaceans [2]. Recently, in Europe traditional timber species started to be substituted not only by tropical ones, but also by a wide series of treated wooden-based materials as well as completely artificial ones. Indeed, they are supposed to be more resistant to water mechanical action and wood-boring agents, lowering the related management costs, but with unknown environmental implications. In Venice Lagoon, wood is extensively used for maritime works, especially mooring piles and navigation channel marks (named "briccole") (approximately 7,000). In addition to the degradation caused by natural and man-made physical factors, timbers are characterized by strong biotic degradation phenomena. It has been estimated that along the shipping channels there are about 22,000 wooden piles constituting the briccole and between 5,000 and 10,000 wooden piles are present for boats mooring. Each year, a large number of them must be replaced. Recently, it was observed that their turn-over increased, probably as a consequence of a higher biological activity of marine wood borers such as the molluscs *Bankia carinata*, *Lyrodus pedicellatus*, *Nototeredo norvegica* and *Teredo navalis*, the isopods *Limnoria lignorum* and *L. tripunctata* and the amphipod *Chelura terebrans*. The problem of protecting wooden constructions in the Lagoon is of considerable interest mainly for navigation safety and environment protection as well as under the economical viewpoint. Various solutions were suggested such as the use of high durability essences, the application of physico-chemical protections or the opportunity to take into consideration alternative materials (e.g. plastics or recycled plastics). The aim of the currently ongoing research study is to assess a discrete set of piling materials (n = 16) in order to verify their durability towards mechanical water stress, their sea water ecotoxicity and the potentiality for wooden ones to be biologically degraded, considering both *in situ* and *ex situ* experimental activities.

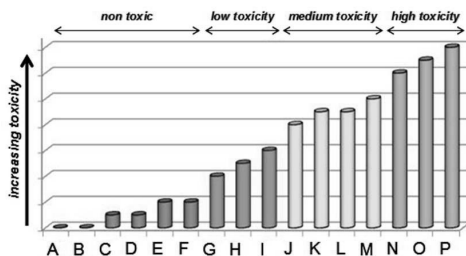


Fig. 1. The investigated piling materials (# 16) present leachates with various toxicity levels towards saltwater biota.

In situ experiments have been set up to obtain bioaccumulation data from active and passive biomonitoring using mussel exposure, to characterize and evaluate the intensity of wood borers attacks on lagoon scale, to define a

preliminary model of habitat suitability and to increase the ecological knowledge of the main species of wood boring invertebrates. *Ex situ* activities have been scheduled to assess the potential ecotoxicological hazard of leachates generated by piling materials under various exposure conditions considering a battery of sensitive seawater toxicity testing species (i.e. bacteria, algae, molluscs and crustaceans). The final aim is to supply policymakers and stakeholders with a series of scientific criteria in order to manage the phenomenon of timbers turn-over and, specifically, to compare the usage of traditional and alternative piling materials as well as other protective add-ins.

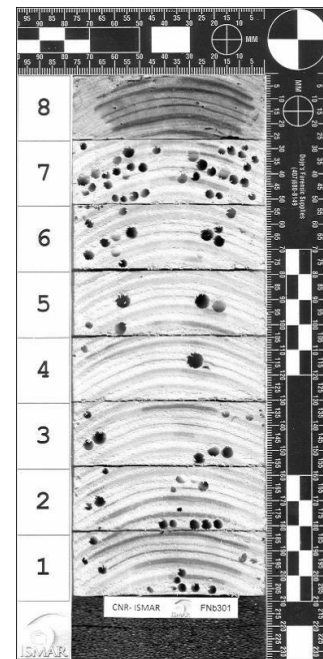


Fig. 2. Galleries produced by the teredinids from one of the test wood blocks installed in the Venice lagoon (Italy).

Acknowledgements: This work was granted by the Water Authority of Venice (Magistrato alle Acque di Venezia) through its concessionaire Consorzio Venezia Nuova.

References

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