H53 The Utility of Barnacles in Forensic Investigations

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After attending this presentation, attendees will understand the usefulness of barnacles in determining a postmortem submergence time and/or floating time of remains in a marine environment. This, when coupled with sea current knowledge, can impact the provenance of those remains.

This presentation will impact the forensic science community by providing awareness regarding submerged remains as to what to observe and collect and how barnacle growth rate can aid in the total minimum Postmortem Interval (minPMI).

Estimating the minPMI is a necessary part of a forensic investigation. Besides the pathologist's assessment of the typical signs of death, minPMI can be estimated using forensic entomology, the scientific discipline that considers insects and other arthropods that colonize the remains. In an aquatic environment, insects as well as crustaceans have the potential to provide data regarding the time the remains have spent in the water (i.e., Floating Time (FT) and Post Mortem Submersion Interval (PMSI)), and this can also assist in determining the minPMI.

Barnacles (Crustacea: Cirripedia) are common crustaceans that colonize solid and durable substrates in marine environments and can often be found in association with human and animal remains floating in the sea. Scientific literature reports that barnacles are typically found colonizing shoes. Barnacles can colonize both floating remains and submerged remains and their growth rate is dependent on the water temperature. Despite their potential to be indicative of the FT and/or PMSI, at present, research is depleted and only a few case studies have considered it for this purpose.

The present research is focused on the barnacle colonization of different types of shoes (sporty vs. elegant) placed in the sea (Boston Harbor, Boston, MA). The objectives of this study were: (1) the identification of the species of barnacles that colonize shoes; (2) the identification of the settlement preferences of the barnacles associated with the shoes; and, (3) to determine the growth rate of the barnacles associated with the shoes.

For the purpose of this research, in early March 2016, 64 sport shoes and 64 patent leather shoes were placed in the Boston harbor at 8m–10m below the sea level. Four of each shoe type were collected every two weeks from April 2016 to November 2016, inclusive. Each shoe was photographed and the barnacles and other sea life colonization was documented. Individual barnacles from each shoe were sampled and measured to determine species and age as well as the overall colonization density and settlement preference. Data loggers were placed with the shoes to record temperature throughout the course of the study.

Results show that *Amphibalanus improvisus* (Darwin) (Crustacea: Cirripedia: Sessilia) colonized the vast majority of shoes. Colonization occurred quickly and continued throughout the study period. A significant difference in colonization densities was found between the sport and patent leather shoes, with the patent leather seeing higher densities. Barnacles also showed preferential colonization of specific sections on both shoe types. Overall, higher quantities of barnacles were found on the exteriors and bottoms of shoes and low quantities of colonization on the insides, tongues, and laces. Barnacle growth was found to be significantly affected by water temperature. Statistical analysis of the effect of water temperature, time, and shoe type on the size of the largest barnacle revealed a highly significant effect from temperature and shoe type and no significant effect from time. Time and shoe type had a highly significant effect on the total number of barnacles per shoe, whereas water temperature had no significant effect.

Barnacle, PMSI, Growth Rate

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