H40 Microbial Marine Decomposition: Marine Bacteria as an Indicator of Postmortem Submersion Interval

Gemma C. Dickson, BSc, and Russell T.M. Poulter, PhD, University of Otago, Department of Biochemistry, PO Box 56, Dunedin, Otago 9054, NEW ZEALAND; Jules A. Kieser, PhD, University of Otago, Sir John Walsh Research Institute, Faculty of Dentistry, PO Box 647, Dunedin, Otago 9054, NEW ZEALAND; Elizabeth W. Maas, PhD, National Institute of Water & Atmospheric Research, Ltd. (NIWA), Private Bag 14901, Wellington, Otago 9054, NEW ZEALAND; and P. Keith Probert, PhD, University of Otago, Department of Marine Science, PO Box 56, Dunedin, Otago 9054, NEW ZEALAND*

After attending this presentation, attendees will gain a greater understanding of the involvement of marine bacteria important to the process of decomposition of bodies and/or body parts in marine environments, specifically a temperate New Zealand coastal environment. This presentation will provide marine bacterial succession data from pig (*Sus Scrofa L.*) heads submerged in this coastal region during autumn, winter, and summer and will demonstrate how such data may be used by forensic investigators to aid in submersion interval estimation.

This presentation will impact the forensic community by increasing forensic knowledge on the role of extrinsic microbes in the postmortem decomposition process, while introducing the concept of marine bacterial colonization and succession on bodies recovered from marine coastal contexts as a novel, and potentially valuable, tool with which to estimate the length of time of submergence and the postmortem submersion interval (PMSI) of a corpse or individual body part.

Much is now understood regarding the involvement of microorganisms in taphonomic processes on remains in terrestrial settings, however very little is known about the role of bacteria and pattern of degradation of animal remains in aquatic environments. Because heterotrophic bacteria are ubiquitous in aquatic ecosystems and are ecologically important for the recycling of specific nutrients in the oceans, it is hypothesised that extrinsic bacterial action will mediate the progressive decomposition of remains immersed in the sea and that the actions of successive bacterial species may act as indicators as to the period of submersion. This is important for forensic professionals in coastal locations as bodies recovered from the sea form a significant portion of cases for PMSI determination.

This study used adult domestic pig (*S. scrofa L.*) carcasses as models for human remains. Pig heads were placed in cages surrounded by mesh so as to exclude larger scavengers and gain the longest submersion period possible for bacterial colonisation. Cages were submerged in the Otago Harbour in water 3-5 m deep in March (autumn), July and August (winter) 2007 and January (summer) 2009. Bacterial samples were taken by swabbing the carcasses at two to four day intervals until skeletonisation. Total bacterial community DNA was extracted from the swabs and colonising marine bacteria identified by sequencing their 16S rDNA genes. On sampling days, observations of gross decomposition changes and the presence of any small marine scavengers in or on the cage were also noted. During the course of the experiments, environmental data such as seawater temperature were monitored daily.

Marine bacteria rapidly colonised the submerged remains and did so in a successional manner. Marked differences were observed in the structure of microbial communities identified on the pig remains during the different seasons, thus showing a seasonal succession pattern, for which a significant difference in water temperature is likely to have been a contributing factor. Several bacterial species were present for much of the duration of the experiments while others only colonised after specific submersion intervals.

Determining the length of time a body has been immersed in an aquatic environment is a crucial factor that must be determined in any death investigation. The dynamic shifts in marine microbial community composition over a submersion period, as seen in this study in the form of relatively early or late colonisers, may be useful as submersion indicators. The data generated now forms the basis for development of a novel indicator of PMSI in the sea and, with further study, may prove useful for PMSI estimation of bodies and/or body parts recovered from coastal marine waters in the Otago region and beyond in cases where a specific PMSI is in doubt.

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