
Microbial Hazards in Changing Coastal Environments



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BSc Hons

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Ocean Microbiology Group & Climate Change Cluster

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Thesis Abstract

Coastal environments deliver many crucial ecosystem services, such as maintenance of biodiversity, and are used widely for recreation by human populations. While microbial communities within these environments underpin ecosystem services, they often incorporate pathogenic microbes (e.g., *Vibrio* species) that can proliferate under beneficial environmental conditions. Furthermore, pathogens and antimicrobial resistant bacteria (ARB), enter coastal environments via sewage contamination or animal faeces. Many processes which underpin the dynamics of endemic microbial hazards and anthropogenically introduced microbial hazards are not well defined, which hinders remediation efforts. Therefore, I aimed to increase our understanding of these processes. In Chapter 1, I introduce coastal environments, their microbial ecology, and their associated microbial hazards. In Chapter 2, I analysed the latitudinal dynamics of *Vibrio* along the eastern coast of Australia, where I defined their patterns in the abundance and diversity to reveal new insights into the distribution of potential human pathogens within a region experiencing significant ecological shifts due to climate change, along a latitudinal gradient which, in many locations have had no assessment of *Vibrio* ecology. In Chapter 3, I used Microbial Source Tracking (MST) to specify sources of faecal pollution and their impact on an urban beach, which helped to identify remediation targets. In this chapter, I applied the Bayesian statistical package *Source Tracker* to both track the spatiotemporal dynamics of specific bacterial signatures for individual stormwater drains and to quantify the relative strength of the microbial signature from different stormwater drains. To the best of my knowledge, this is the first time *Source Tracker* has been applied in this way. In Chapter 4, I investigated how rainfall leads to elevated levels of AmR bacteria at a recreationally used coastal beach. To do this, I applied the *indicspecies* statistical R package to 16S amplicon data and ran a correlation analysis between the bacteria which were indicators of sewage, with both faecal markers, and ARB. This is the first time this type of analysis has been applied in this context and it revealed strong positive correlations between faecal contamination, bacteria from storm water drains, ARB, and potential human pathogens. In this chapter In Chapter 5, I aimed to define the relative importance of natural environmental perturbations and anthropogenic impacts on bacterial assemblages within intermittently opened and closed lagoons (ICOLLs). This is the first study to provide a detailed spatial and temporal analysis of the microbial communities within ICOLL environments. In this study, I observed that sewage was a principal driver of shifts in the microbiology of ICOLLs exposed to stormwater, while natural seasonal shifts in the physio-chemical parameters controlled

microbial communities at other times. Finally in Chapter 6, I synthesise the results and conclusions of this thesis. Overall, the findings of this project have brought a new understanding to how microbial hazards can proliferate in, and enter, coastal environments. This project has also informed the water quality strategies of government agencies, and in some cases highlighted significant health risks to recreational users of coastal environments.