Research Title

Using 16S rRNA sequencing as a surveillance tool for the monitoring of rural Māori community drinking water supplies in the Aotea Harbour

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Summary

This research project is in alignment with Te Niwha's mission to ensure Aotearoa New Zealand has world-class research capability to support our preparedness for current and future infectious disease challenges.

Waterborne disease outbreaks can occur for a number of reasons including distribution system deficiencies, inadequate treatment and maintenance practices, leakage issues with sewage conduits, and heavy rainfall events. Approximately 15% of Aotearoa, New Zealand's population, are solely reliant on private drinking water supplies such as bores, well, streams, and rainwater collection tanks. These private drinking water supplies are not covered under current legislation and the drinking water standards. Without regulatory oversight, these private drinking water supplies are highly vulnerable to contamination as a result of improper treatment, maintenance, and monitoring regime. The primary purpose of focusing this research specifically on rural Māori community drinking water supplies (marae tank water systems, private household supplies, ground and surface water sources) is due to the disproportionate adverse health outcomes Māori face in the current climate. Like many other indigenous people around the world, the impact of colonization in Aotearoa, New Zealand is laid bear with the inequitable distribution of a number of social and economic conditions between Māori and non-māori. Health in particular is an area of great concern, as Māori continue to suffer the highest rates of most major diseases (i.e., diabetes, cardiovascular disease, respiratory disease, stroke), leading to higher rates in morbidity and mortality. Māori are also more likely to live rurally and in deprived circumstances (i.e. poor household infrastructure and lack the resources to install and maintain proper treatment facilities). There is an imminent need for drinking water quality research in rural Māori drinking water supplies as climate change continues to threaten the ability of rural households to maintain a constant supply of safe drinking water.

At present culture-based methods are still globally regarded as the 'gold standard' for drinking water quality monitoring. This is largely due to factors such as cost-effectiveness, wide applicability, reliability, and ease of use. However, culture-based methods are often criticized for their time-consuming nature, organism specificity, and limited sensitivity for low abundance microbes. Next-generation sequencing is a more recent advancement in the

field of water quality monitoring, one that further enhances bacterial identification in environmental samples. This is achieved through deep amplicon sequencing of a marker gene (most commonly 16S rRNA gene) which can be used to profile the entire microbial community within a sample. In comparison to culture-based methods, next-generation sequencing (16S rRNA sequencing) is a comprehensive and rapid method to monitor drinking water. One that could significantly increase the capability of rural residents to effectively monitor and maintain the quality of their drinking water systems. Therefore, improving the chances of preventing future contamination events and the spread of infectious diseases. The overall goal of this research is to ascertain the effectiveness of next-generation sequencing technology such as 16S rRNA sequencing as a potential surveillance tool to aid in the monitoring of rural Māori community drinking water supplies in the Aotea Harbour.

Aside from the potential application of next generation sequencing methods, this research project aims to connect the rural Māori community of Aotea Harbour with their drinking water sources through the integration of microbial data and local mātauranga. This research intends to combine seasonal microbial data gathered from 16S rRNA sequencing and mātauranga (oral histories, lived experiences, and long-term observations) from local hapu. This approach will allow for scientific conclusions to complement the cultural paradigms drawn from Kaupapa Māori research. Presenting mātauranga alongside 16S rRNA sequencing may improve the collective rural community understanding of seasonal drinking water quality and encouraging preventative action towards potential contamination events. In doing so, may provide a strong basis for mātauranga Māori and microbial data to draw similar conclusions from differing yet complimentary viewpoints. Offering deeper ecological insights and more explanatory power than traditional singular disciplinary research.

At present, this PhD research project is still in the early stages of progression with the first round of sample collection, sample analysis, and participatory mātauranga interviews scheduled to commence mid-January 2026.