Transition in *Vibrio* spp. correlates with human activity in the Northern Line Islands

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**Introduction**

The initial microbiological survey of the Northern Line Islands showed that most cultured Vibrio species were found on Kiritimati, fewer on Tabuaeran and Palmyra, and least on Kingman. In contrast, a culture-independent survey by metagenomics – random sequencing of environmental DNA – from these islands showed relatively consistent numbers of *Vibrio* spp. at each island. Neither the culturing nor the metagenomics could accurately identify the exact species present. Therefore, we used a multi-locus sequencing approach (MLSA) to analyze the water samples at each island. In addition, to determine whether the changes in *Vibrio* population were biogeographic or human influenced, culture-dependent and culture-independent surveys were conducted around Kiritimati Island. Kiritimati was chosen based on the distribution and activity of people around the island. The culture-independent surveys provides a non-biased assessment of the *Vibrio* spp. in the environment, whereas culturing was developed to selectively identify microbes, particularly those that were disease causing.

**Methods**

- Collecting water and coral samples from different transects
  - Filtering seawater through a filter to isolate bacteria
  - Pick colonies and store in Allprotect Tissue Reagent
  - Count grown colonies
- Extract DNA from filters using beads
  - PCR microbial DNA with *Vibrio*-specific primers
  - Clone PCR products into E. coli
  - Pick colony and sequence

**Northern Line Islands survey**

Overview of Kiritimati Island showing the 5 sites where water and coral samples were collected. The pie charts show the abundance of bacteria based on the culture-dependent MLSA analysis.

**Pathogenic *Vibronaceae* found**

- *Vibrio harveyi* - pathogen to fish and invertebrates, including lobster and shrimp
- *Photobacterium coralii*
- *Vibrio corallilyticus*
- *Vibrio shilonii*

**Results**

The analysis demonstrates that there is a consistent background of *Vibrio* spp. present everywhere and detectable by metagenomics, and additional species present at the specific locations where *Vibrio* were readily cultured. Within the *Vibrio* strains identified across the islands there appeared to be more pathogenic strains present on Kiritimati where the ecosystem had undergone some perturbation. The culture-dependent and culture-independent surveys around Kiritimati Island recapitulate this result. Only one species of *Vibrio* (*V. harveyi*) was found on Kiritimati closest to the highest levels of human activity, suggesting that human activity reduced the diversity of the microbial populations and encouraged the growth of potentially pathogenic strains. The prevalence of coral disease was highest on these reefs near the human population and the changes to the microbial population may be a leading cause. This study demonstrates a correlation between human activity and *Vibrio* spp. population and removes some of the confounding factors, such as latitude, which were present in the inter-island study.

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**Further information**

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This paper is available online at edwards.sdsu.edu/posters/icrs2008.pdf

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