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LONG-TERM ENVIRONMENTAL MONITORING OF THE MARINE COMMUNITIES AT MCMURDO STATION, ANTARCTICA

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McMurdo Station is the largest inhabited station in Antarctica, with a summer population often in excess of 1,000 people. Human activities in the area have contaminated and disturbed adjacent marine habitats and past observations have revealed high concentrations of contaminants in marine sediments as well as disturbed benthic communities. Waste and sewage disposal as well as non-point pollution are common past occurrences in marine areas adjacent to McMurdo Station. Monitoring areas of known disturbance is necessary to manage, quantify, mitigate and minimize anthropogenic impacts.

Fixed-point and probabilistic sampling designs were compared to determine the best design for long-term monitoring of the marine environment adjacent to McMurdo Station, Antarctica. The fixed-point sampling design included transects along historical contamination and physical disturbance gradients. The probabilistic sampling design used a grid network of 50-m diameter hexagons to randomly select sampling stations. Fifteen stations within a ~ 1 km^2 area were sampled using each sampling design. The study area extended from Winter Quarters Bay to Cape Armitage Monitoring was conducted by analyzing marine sediments for chemical contamination, toxicity, and macrobenthic community structure. Few stations sampled in the probabilistic sampling design had medium or high concentrations of chemical contaminants or high levels of toxicity. Stations from the fixed point sampling design covered the contamination and toxicity gradients more evenly. This indicates that anthropogenic disturbance originating from McMurdo Station is strongly localized and that the fixed-point design is better for long-term monitoring of the area.

A benthic index of biotic integrity (B-IBI) was also created to analyze the macrobenthic community response to environmental quality. In the fixed sampling design, correlations with chemical contamination and toxicity were higher with the B-IBI than with conventional macrofaunal abundance and species richness (N0).