Microbial Communities at Very Low Temperatures in Natural Saline Ice Formations

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The majority of our solar system exists in a state of perennial cold, but there are few locations and opportunities to study life on Earth at particularly extreme temperatures. The coldest habitat on Earth in which a significant fraction of liquid water persists is wintertime sea ice (where the eutectic lies below -35°C). We studied Arctic sea ice during the coldest months of the year (January through March) to determine if the encased microbial communities react to similar environmental stresses (i.e. high salinity, low temperature) by altering community composition in similar ways. Of three depth horizons in the ice (centered at 25-, 45-, and 65-cm below surface), total microbial abundance (as measured by DAPI staining) did not change significantly in two of the horizons, even as the temperature of each ice horizon decreased an average of 18°C (to a minimum measured in situ temperature of -28°C) over the course of about 10 weeks. Detection of a change in community composition in these sections would indicate growth by selected members of the community under the extreme conditions of the ice. We have begun direct measurements of community composition in the ice from these horizons using terminal-restriction fragment length polymorphism (T-RFLP) analysis, to learn whether the community composition was static or dynamic during the winter season. We expect to observe a decrease in diversity as the more extreme conditions developed and provided selective pressure against common seawater microorganisms in favor of those adapted to life at high salinity and low temperature