Chemical & Physical Sciences
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Predicting microbial ecosystem shifts in the changing Arctic

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A biogeographic range shift occurs when an ecological community or certain individual species relocate in an attempt to track changing environmental conditions. While attempting to track changes in ecologically critical factors such as sea surface temperature, organisms may be forced to migrate into a region where other environmental factors (e.g., specific substrate conditions, water depths) are less common or entirely absent. When this occurs, competition between organisms can increase, and in extreme cases extinction and ecological collapse can follow. As warming temperatures in the polar regions alter the spatial extent and occurrence of ecologically-relevant environmental features such as sea ice, specialized cold-adapted organisms are expected to experience a poleward range shift. Here I characterize some of the potential taxonomic and functional changes that may result from these changes, by exploring microbial community composition along a short latitudinal gradient in western Greenland. Results suggest a dramatic decrease in the relative abundance of psychrophilic (cold-adapted) marine bacteria with increasing sea surface temperatures and declining sea ice coverage. As many psychrophilic bacteria produce highly specialized polymers capable of ameliorating micro-scale ecological conditions in areas that experience annual sea ice formation (in turn allowing less specialized microorganisms to survive in the area), a reduction in the abundance of these organisms with increasing Arctic sea surface temperatures may have outsized effects on community composition. I discuss some of these potential changes and consider the potential implications for the predicted “Sixth Mass Extinction”.