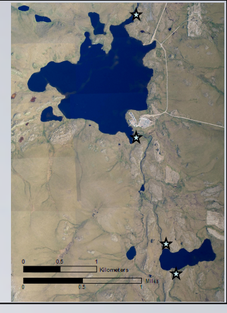
Comparing temperature responses of polar lake bacteria



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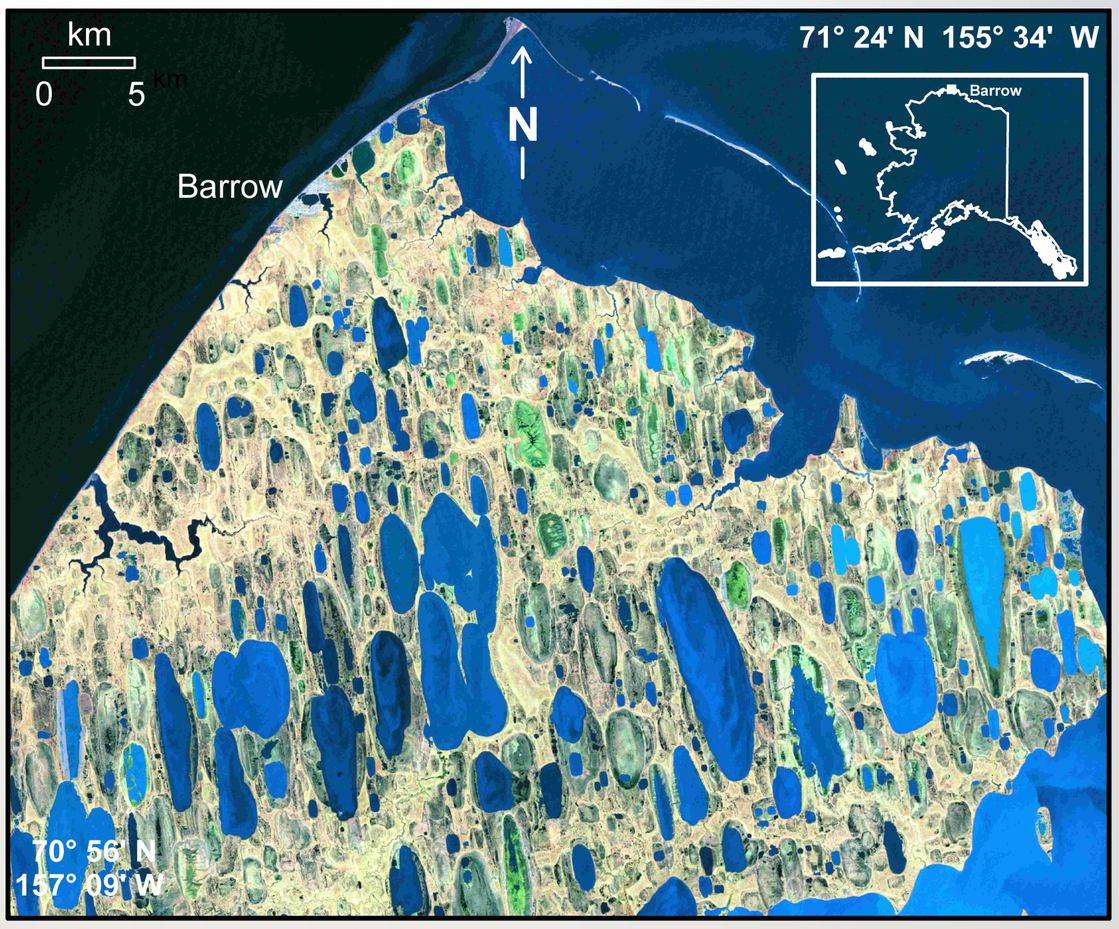
Dry Valley lake bacterial communities are predicted to respond to temperature similarly to arctic bacterial communities.

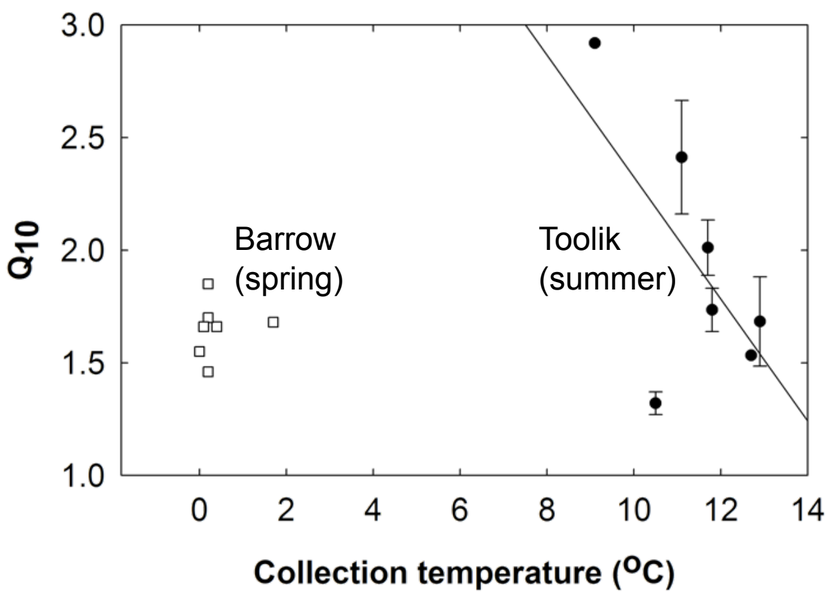
Background:

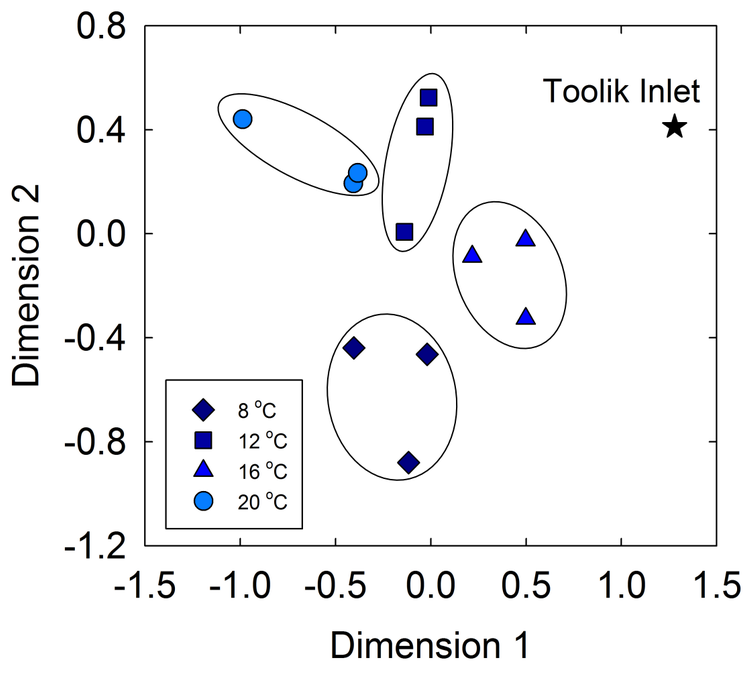
Bacterial communities contain a mix of populations with different metabolic capabilities, including response to temperature. Understanding temperature responses of natural bacterial communities is fundamental to predicting responses to climate change, as well as evaluating the potential for life in icy habitats beyond our planet.

Hypothesis: Polar aquatic bacterial communities are similar in their temperature responses and contain groups with different temperature optima which dominate under different conditions.



Barrow area lakes, Alaska.





Top panel: Q_{10} short-term temperature response for bacterial communities from Barrow area lakes collected in the spring and from Toolik area inlets and outlets collected in the summer. Toolik R^2= 0.41.
Bottom panel: NMDS plot of bacterial communities from Toolik inlet incubated at different temperatures for five days, normalized raw stress= 0.03. (both modified from Adams et al. 2010)

Lake Bonney temperature experiments:

Water will be collected from the west lobe of Lake Bonney, with communities incubated at a range of temperatures from 2 to 20 ºC.

Short-term linear increases of bacterial productivity in response to temperature are predicted, such as those measured at several lakes on the North Slope of Alaska in the Barrow and Toolik areas (Adams et al. 2010). However, preliminary experiments at Lake Fryxell and the east lobe of Lake Bonney indicate decreasing productivity with increased temperature (T. Vick, pers. comm.).

Longer incubation is predicted to result in differential productivity and select for distinct communities at different temperatures (bottom panel at left).

Communities that develop during incubation will then be tested for variation in productivity responses to temperature (Q_{10}). Summer arctic communities were more susceptible to changes in temperature when water temperatures were cold and selection may replicate this pattern (top panel at left).

Implications:

In the Arctic, warming could result in suboptimal conditions for both psychrophilic and psychrotolerant bacteria during the summer season. It is predicted that bacterial communities in Antarctic lakes share these characteristics and consist of groups with distinct temperature optima.

Adams, H.E., B.C. Crump, and G.W. Kling. 2010. Environ. Microb. 12(5): 1319-1333.
Barrow map from **http://www.geography.uc.edu/~kenhinke/dtlb/**

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