

# Niche Specialization of Bacterial Residents in Permanently Ice-covered Lakes of the McMurdo Dry Valleys, Antarctica

Miye Kwon<sup>1, 2§</sup>, Mincheol Kim<sup>1,3§</sup>, John C Priscu<sup>4</sup>, Soon Gyu Hong<sup>1</sup>, Joohan Lee<sup>5</sup>, Sang Jong Kim<sup>2</sup>, and Ok-Sun Kim<sup>1\*</sup>

<sup>1</sup>*Division of Polar Life Sciences, Korea Polar Research Institute, Incheon 406-840, Korea,*<sup>2</sup>*School of Biological Sciences, College of Natural Sciences, Seoul National University, Seoul 151-747, Korea,*<sup>3</sup>*Arctic Research Center, Korea Polar Research Institute, Incheon 406-840, Korea,*<sup>4</sup>*Department of Land Resources and Environmental Sciences, Montana State University, Bozeman, MT 59717, USA,*<sup>5</sup>*Department of New Antarctic Station, Korea Polar Research Institute, Incheon 406-840, Korea*

Perennially ice-covered lakes across McMurdo dry valleys are chemically stratified and characterized by their own distinct limnology and biogeochemistry. Despite the specialty of ecological features in these extreme environments, detailed information about what microbes reside and how they differ by different lakes and depths are still little understood. Here, we investigated bacterial diversity in five different ice-covered Antarctic lakes at a range of depths using 16S rRNA gene-based pyrosequencing. Although more similar compositions found towards upper layers, bacterial communities are overall distinctive to each lake and depth, with paralleling their unique biogeochemical characteristics. Surprisingly, certain bacterial lineages are exclusively confined to a specific depth of each lake. Candidate division WM88 occurred at 15 m depth of Lake Fryxell solely, while unknown lineages of *Chlorobi* are found only at the depth of 18 m in Lake Miers. The 30 m depth of East and West Lake Bonney was occupied by two distinct *Firmicutes* classes. Different size fractions and strong associations with various physicochemical variables give additional information about ecology and metabolic potential of these bacteria. These mysterious features would be consequences of their long-lasting adaptations to the extreme and unique environments of ice-covered lakes in Antarctica.