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A New Thermal Categorization of Ice-covered Lakes

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Lakes are traditionally classified based on their thermal regime and trophic status. While this classification adequately captures many lakes, it is not sufficient to understand seasonally ice-covered lakes, the most common lake type on Earth. We describe the inverse thermal stratification in 19 highly varying lakes and derive a model that predicts the temperature profile as a function of wind stress, area, and depth. The results suggest an additional subdivision of seasonally ice-covered lakes to differentiate under-ice stratification. When ice forms in smaller and deeper lakes, inverse stratification will form with a thin buoyant layer of cold water (near 0^{o}C) below the ice, which remains above a deeper 4^{o}C layer. In contrast, the entire water column can cool to ~0^{o}C in

larger and shallower lakes. We suggest these alternative conditions for dimictic lakes be termed “cryostratified” and “cryomictic.”