

The authors did a nice job adequately addressing most of the reviewers' comments. In particular, the methods are much more clear now. However, the writing still needs some work. There are some sentence fragments and run-on sentences, some citations seem incorrect or out of place, and in many places it is difficult to understand the authors' argument. I have made some suggestions below, but I recommend additional editing and revising.

Line 1 (Title) - Suggestion - Diversity and assembly processes of microbial eukaryote communities in Fildes Peninsula Lakes (West Antarctica)

Line 24: ranges should be indicated by an en dash, not a tilde.

Line 25: when "lake" is used as part of a proper name, it is capitalized, e.g., "lake Chang Hu" should be "Lake Chang Hu".

Line 25: ...with higher values in Lake Chang Hu and Lake Kitec and the lowest value in Lake Yue Ya.

Line 37: The stochastic processes... to Stochastic processes ("the" is unnecessary - check articles throughout the manuscript, "the" is often used when "a" or no article is more appropriate).

Stochastic processes (e.g., homogenizing dispersal and undominated process) dominated community assembly compared to deterministic processes.

Line 39: These findings demonstrate the diversity of microbial eukaryotic communities in the freshwater lakes of the Fildes Peninsula and have important implications for understanding community assembly in these ecosystems.

Line 45: A suggestion: The Fildes Peninsula--which makes up the southwestern end of King George Island, South Shetland Islands, Antarctica--is home to a relatively high density of scientific research stations. The peninsula is commonly ice-free throughout the austral summer, making it the largest ice-free area (40 km<sup>2</sup>) on King George Island. Falling within the maritime Antarctic, the peninsula experiences 400-600 mm of precipitation each year and has an average annual(??) temperature of -3°C. Nevertheless, permafrost and periglacial processes can be found in the region. Lakes on the Fildes Peninsula, along with those found in other ice-free areas of Antarctica, represent the year-round liquid water reservoirs on the continent. Water availability and quality are impacted by sea conditions, macro-fauna usage, and anthropogenic influences, such as solid, volatile, and fluid waste production and disposal. Antarctic lake systems are sentinels for climate change and host globally-relevant microbes and biogeochemical cycles, thus making a more complete understanding of the processes shaping microbial communities there a priority. Moreover, the physical stability observed in these lakes makes them a good model system for interrogating biogeochemical processes within water columns.

Line 61: ranges should be indicated by an en dash, not a tilde.

Line 68: A suggestion: However, microbial eukaryotes in Antarctic lakes have been understudied due to their small cell size and lack of conspicuous morphological features.

Microbial Eukaryotes have not been neglected in all systems - this sentence needs more specificity to be true. Even in the revised form, I suspect many people would object to the statement. Maybe it is better to say that they are less studied than bacteria or zooplankton.

A better (?) suggestion:

Microbial eukaryotes are generally difficult to study due to their small size and common lack of distinguishing morphological features, especially among the pico- and nanoeukaryotes.

Line 79: reflection of environmental conditions

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(needs significant editing for clarity and readability)

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## Methods

How was water collected for Chl *a* and nutrient analysis? Niskin bottle? What volume was filtered through what kind of filter (GFF?) for acetone extracted Chl *a*?

Line 223: the “respectively” is unnecessary

Line 225: OTUs occurring in at least five samples

Line 258: Bastian M et al., 2009 should just be Bastian et al., 2009 ?

Line 261: neutral should not be capitalized

## Results

Lines 283-290 should be rewritten for clarity. There are fragments and run-ons. Again, tildes are not appropriate for ranges.

Line 294: Diveristy and composition of microbial eukaryotic communities

Line 329: over the years [because there is only one sample per year)

Line 332: years

Line 361-2: clustered separately.

Line 371: variability among lakes, but there was still a large amount of unexplained variation.

Line 373: made up the microbial eukaryotic community network

Discussion

Line 416: differs

Line 425: the maritime and continental regions of Antarctica? If not, then remove "the". If yes, say it.

Line 430-437: I think the present tense was correct here

Line 465: states that there should be an increased species number as habitat area increases with a specific area

Line 471: Previous studies have demonstrated

Line 472-473: In this study, we found

Line 477: I would keep water temperature as water temperature throughout the discussion

Line 492: A substantial amount of variation was unexplained, which could be due to a number of reasons. First, it is not possible to measur all environmental factors that can influence microbial communities and, thus, some significant driving factors may not have been included in the study. Potentially vital abiotic factors in Antarctic lakes include: solar cycle, light availability, ice cover (thickness and duration), physical mixing of snow melt, and other hydrological processes. Second, relationships between microorganisms could not be quantified, and these relationships are potentially essential factors shaping community structure. For example, predation pressure can manifest as a top-down control of microbial eukaryotes. Third, ...

Line 507: Network analysis can help illuminate complex biological interactions

Line 514: we found that positive correlations were much more common (82%) than negative correlations (18%). These results suggest that positive relationships (e.g., due to cross-feeding, niche overlap, mutualism, or commensalism) might play a more important role in Antarctic lake ecosystems than negative relationships (e.g., predator-prey, host-parasite, or competition).

527: the clause “and these might weaken the role of environmental selection in community assembly” does not make sense

528: The sentence starting with “Previous studies have shown the high response of microbial ... “ seems completely unrelated to the rest of the paragraph

545 and 549 - I think this should be present tense

552: from aquatic ecosystems

552: For example, picoeukaryotic communities in the lower ...

554: Results from our study supported a more prominent role for stochastic processes than deterministic in shaping the assembly of microbial eukaryotic communities.

557: a small amount of variation in our

565: It is still unclear what is being referred to and why it is significant - I googled what the Middle Route Project of the South-to-North Water Diversion Project is and it does not seem to be related to lakes in polar ecosystems, why did you choose this citation? There must be something published that is more relevant and can better put your findings in context?

Undominant processes should be better defined? I think a better description would help readers.

617: “were proved” seems too strongly worded. Maybe: Stochastic processes and biotic co-occurrence patterns were shown to be important in shaping microbial eukaryotic communities in the area.

621: the sentence starting with “Stochastic processes played a very prominent ... “ is repetitive and should be removed or edited