

Supplemental Information to *Barrett et al.* Weather whiplash in a terrestrial polar ecosystem following the March 2022 Antarctic weather anomaly

Meteorological Measurements and Analyses

Soil temperature was measured just below the soil surface (~1 cm depth) using Campbell Scientific CR10X dataloggers and Campbell 107 temperature probes. Data were sampled every 30 seconds and averaged over 15-minute periods (SI Fig. 1).

Solar flux (SI Fig. 2) was measured using Li-Cor LI-200 pyranometers, which are cosine-corrected silicon photodiodes, with an uncertainty of $\pm 5\%$.

Extreme Weather Events and Precipitation

Rain was noted twice in the McMurdo Dry Valleys prior to the start of the Long-Term Ecological Research (LTER) project in 1993 by Antarctic New Zealand at Lake Vanda Station, though no dates or times are noted (Sansom 1992). The rain events at Lake Vanda recorded by Sansom (1992) are likely to have occurred between 1969 and 1974 when the station was at its peak activity (Howkins et al. 2020). There has been no rain observed since then until 2018, even though there has been consistent human occupation over multiple valleys during the summer field season (Nov.-Jan.), particularly at Lake Hoare Camp in Taylor Valley, which has had continuous human occupation since 1993 during the austral summer season (Howkins et al. 2020).

Supplemental Information Table 1. Documented rain events in the McMurdo Dry Valleys, Antarctica 1968-2023.

Date and time	Location	Duration	Source
Not noted	Lake Vanda Station, Wright Valley	Not noted	Sansom 1992
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Dec. 21, 2018 (0600 local time)	Lake Fryxell Camp, Taylor Valley	Not noted	L. Smarrito Video
Jan. 29, 2019 (0700 local time)	Lake Hoare Camp, Taylor Valley	~ 30 minutes	S. Devlin (MCM-LTER) personal communication

Recent observations of rain include one at 0600 local time on December 21, 2018 (video link) at Lake Fryxell Camp by Laura Smarrito, a Leidos contract carpenter. This was the first documented observation of rain in Taylor Valley. Another was documented at Lake Hoare camp on the morning of January 29, 2019 during the same summer season, which was reported to have

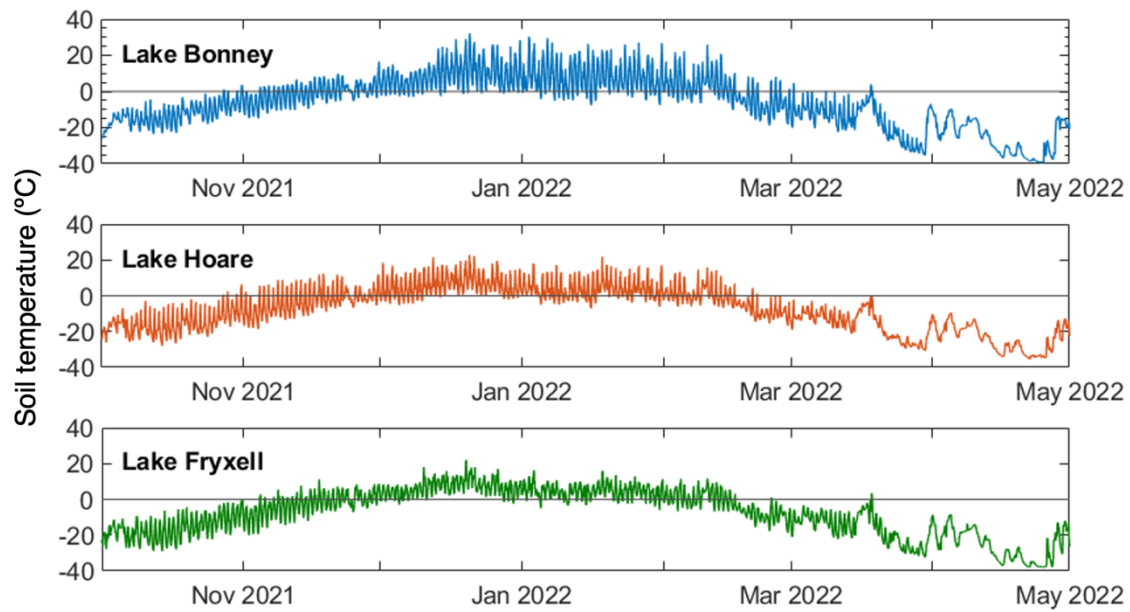
lasted approximately 30 minutes (S. Devlin pers. comm). These records of rain do not include potential events occurring in unoccupied sites during the summer field season in other areas or events that potentially occur during the austral spring or fall. However, automated meteorological records indicate that rain is unlikely outside the austral summer (Fig. 2). We conclude that rain has been an exceedingly uncommon event during the reign of human observations and occupation in the McMurdo Dry Valleys of Antarctica.

Legends for Supplemental Videos

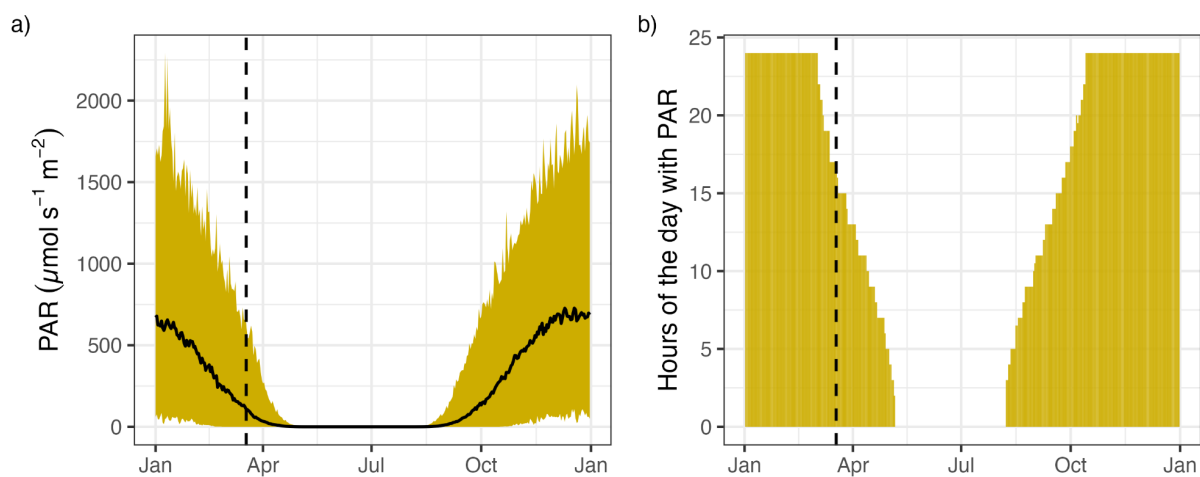
Supporting Information Video 1. Video of rain event, part 1, recorded by Laura Smarrito, a Leidos contract carpenter, at Lake Fryxell Camp, Taylor Valley on Dec. 21, 2018 at 0600 local time.

Supporting Information Video 2. Video of rain event, part 2, recorded by Laura Smarrito, a Leidos contract carpenter, at Lake Fryxell Camp, Taylor Valley on Dec. 21, 2018 at 0600 local time.

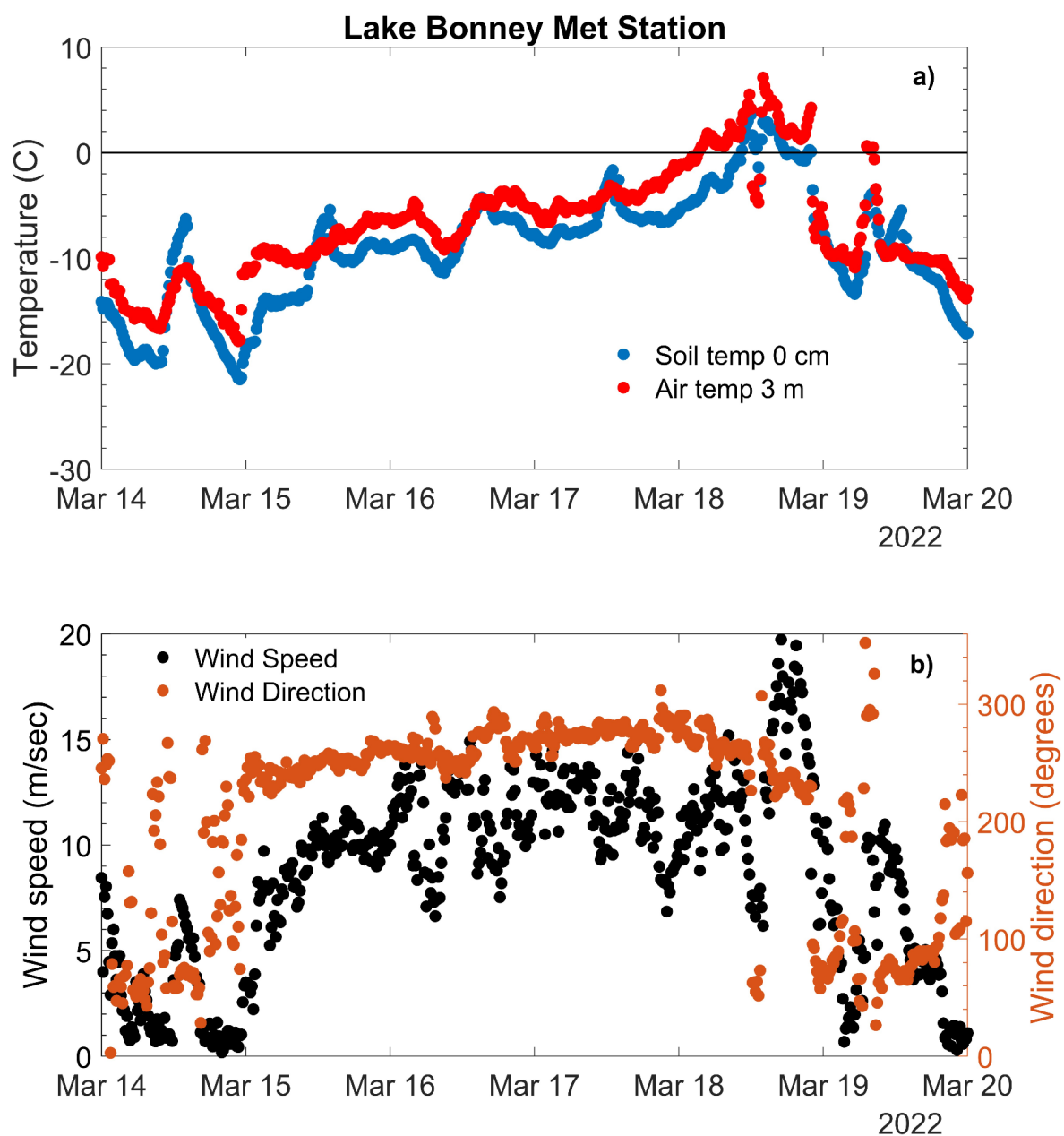
Supplemental Figures



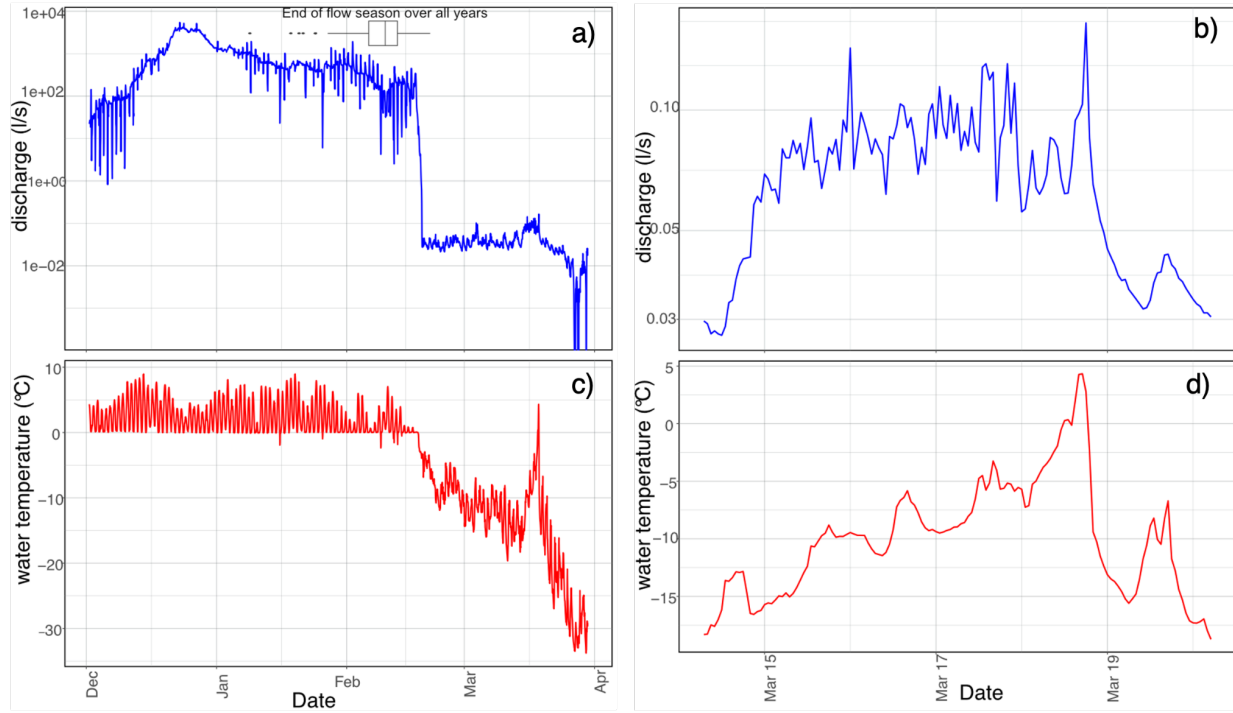
Supplemental Information Figure 1. Surface soil temperature for the Lake Bonney, Lake Hoare, and Lake Fryxell meteorological stations in Taylor Valley, Antarctica.



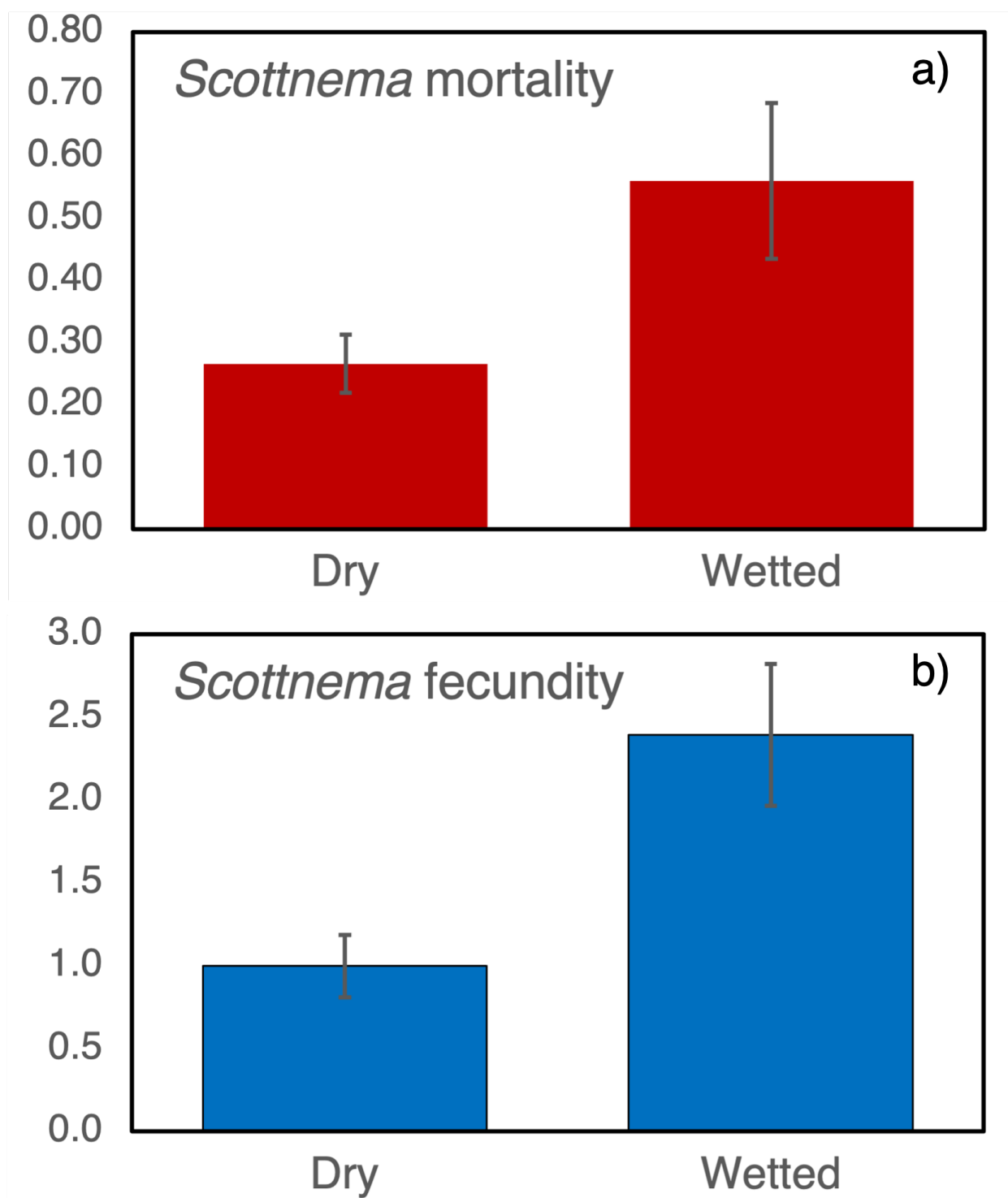
Supplemental Information Figure 2. a) Mean daily PAR (black line) and range of minimum and maximum daily PAR (yellow ribbon) at Lake Fryxell meteorological station from 1994-2021. b) Median hours of PAR $> 0 \mu\text{mol s}^{-1} \text{m}^{-2}$ for a given day at Lake Fryxell meteorological station from 1994-2021. Dashed line indicates March 18th.



Supplemental Information Figure 3. Average fifteen-minute air and surface soil temperature (a) and wind speed and direction (b) for the Lake Bonney meteorological station in Taylor Valley, Antarctica.



Supplemental Information Figure. 4. Stream discharge during December 2021 to April 2022 (a), and for March 14-March 20 2022 (b.), and water temperature for December 2021 to April 2022 (c), and for March 14-March 20 2022 (d.) for the Lower Onyx River in Wright Valley, Antarctica.



Supplemental Information Figure 5. Mortality (dead/live individual, a.) and fecundity (live juvenile/live females, b.) for the free-living endemic soil nematode Scotttnema lindsayae enumerated from soils that experienced unseasonable wetting in March 2022.