



Citizen Science in the High Arctic



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Benefits of Citizen Science for research in remote regions

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UNIVERSITY
OF MANITOBA



De-icing of Arctic Coasts: Critical or new opportunities for marine biodiversity and Ecosystem Services?

www.acces-arctic.com



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Global warming

Sea ice loss

Permafrost thaw

Melting glaciers

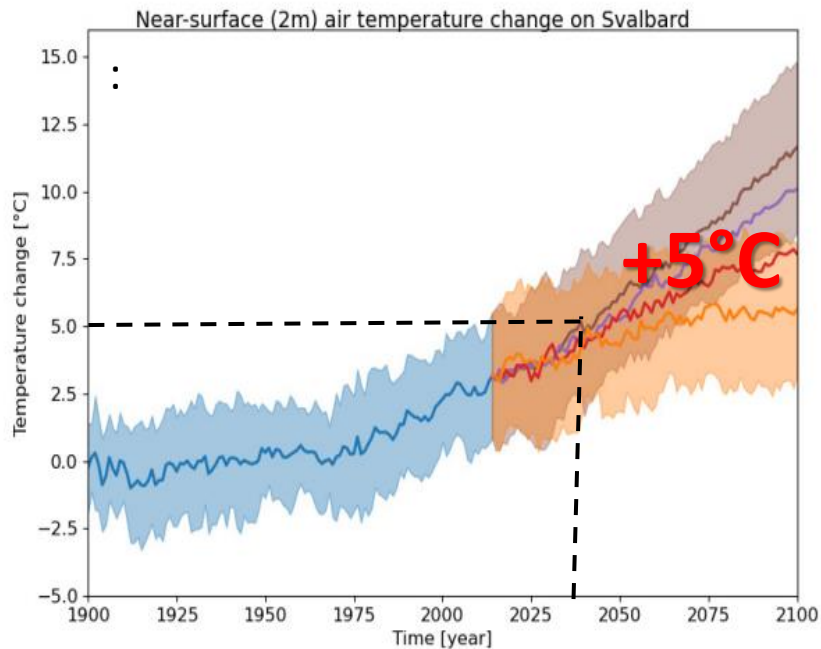
Changes in precip/runoff

Coastal erosion

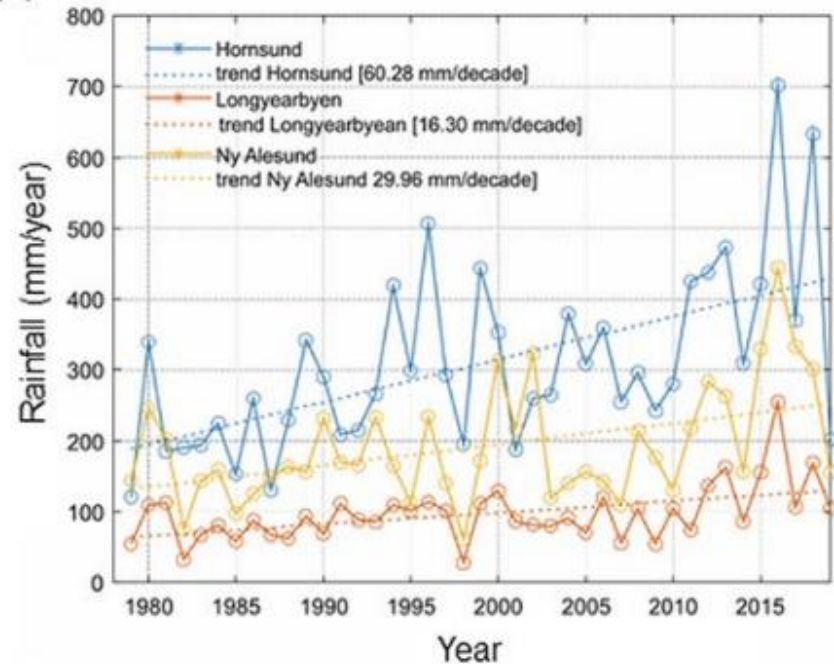
Loss of habitat, increased sea temperatures and stronger land to sea interactions

Will impact timing, magnitude and quality of primary and secondary producers with implications for the coastal marine food web

An increase in air temperature (4-7°C) and in precipitation (45-65%) are expected in near future in Svalbard



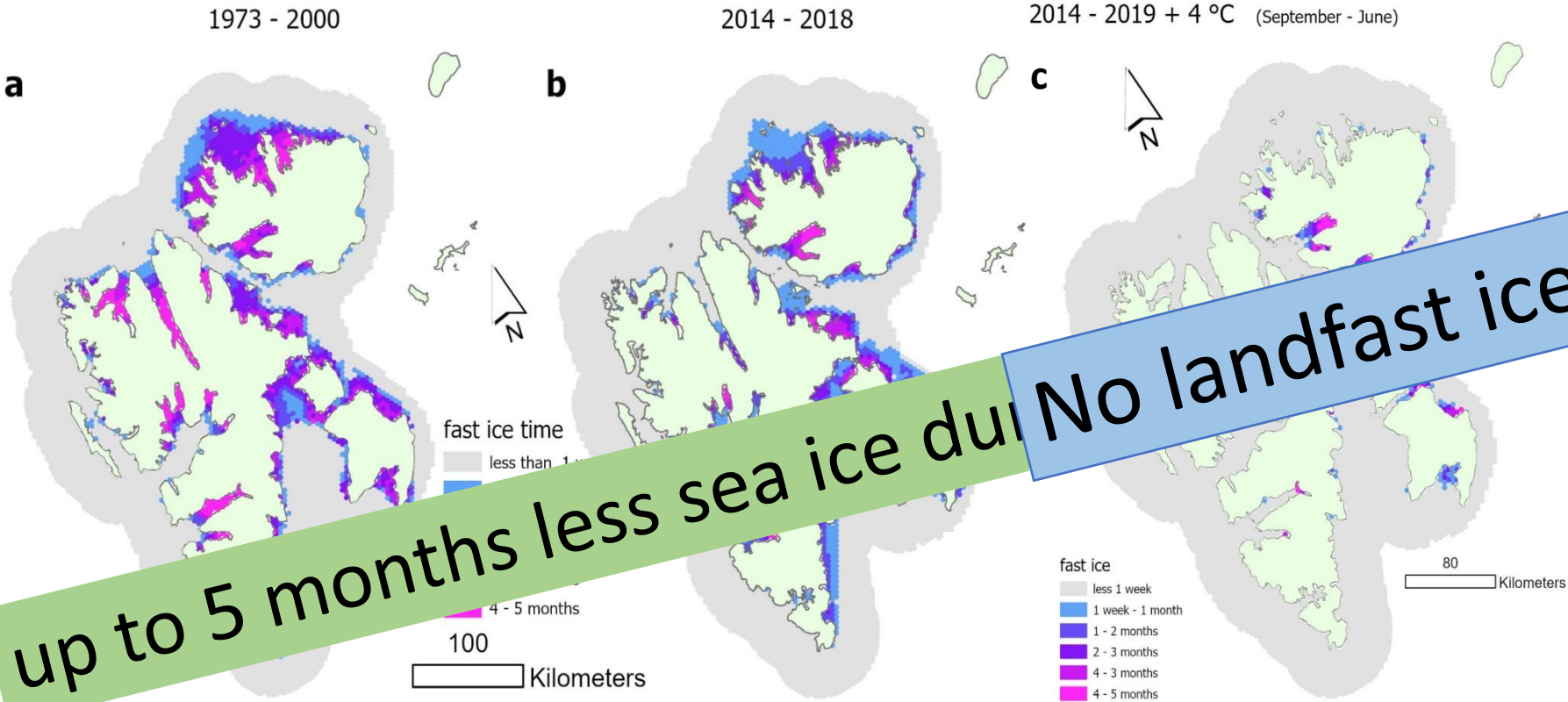
Gjermundsen et al. 2021, SESS report 2020



Nowak et al. 2021, SESS report 2020

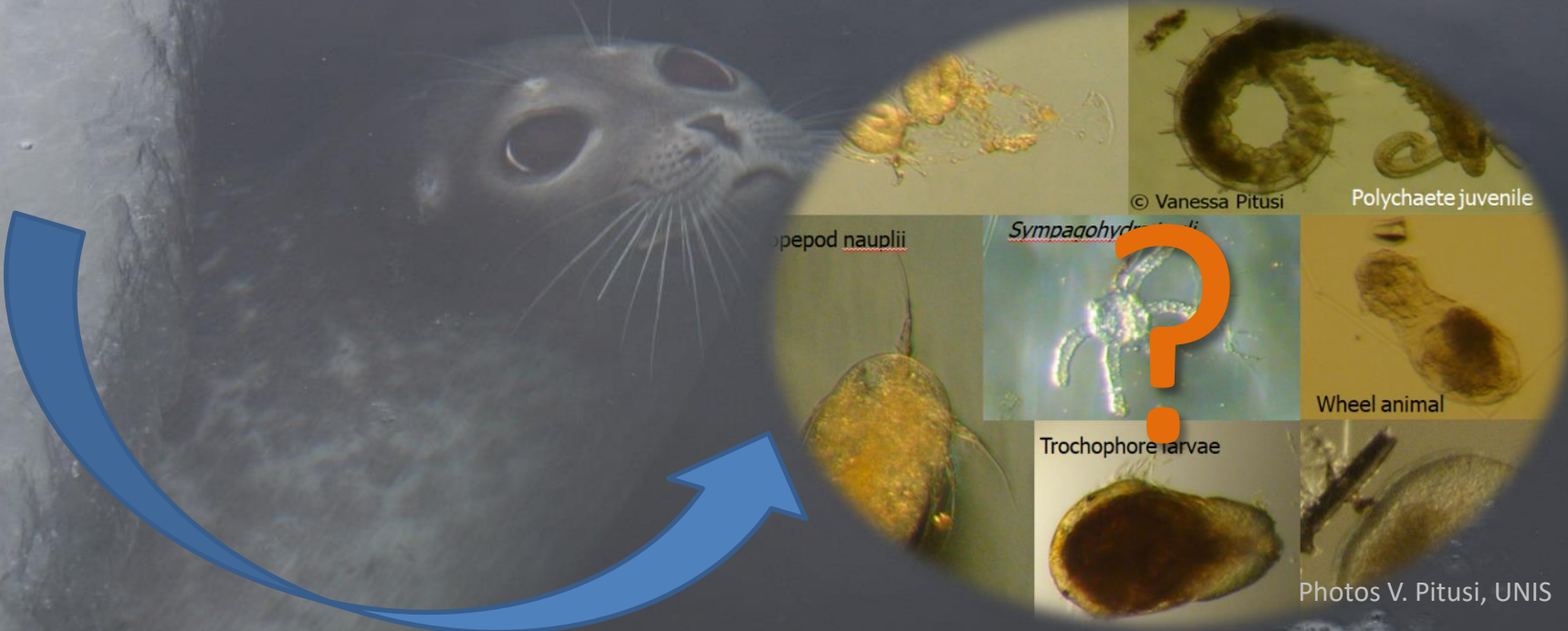
Landfast ice extent and duration in Svalbard

**In future
if +4°C increase in air temp.**



The maps show how long the fast ice lasted . Map (a) and (c) were created using a geographically weighted random forest model, map (b) using observational data.

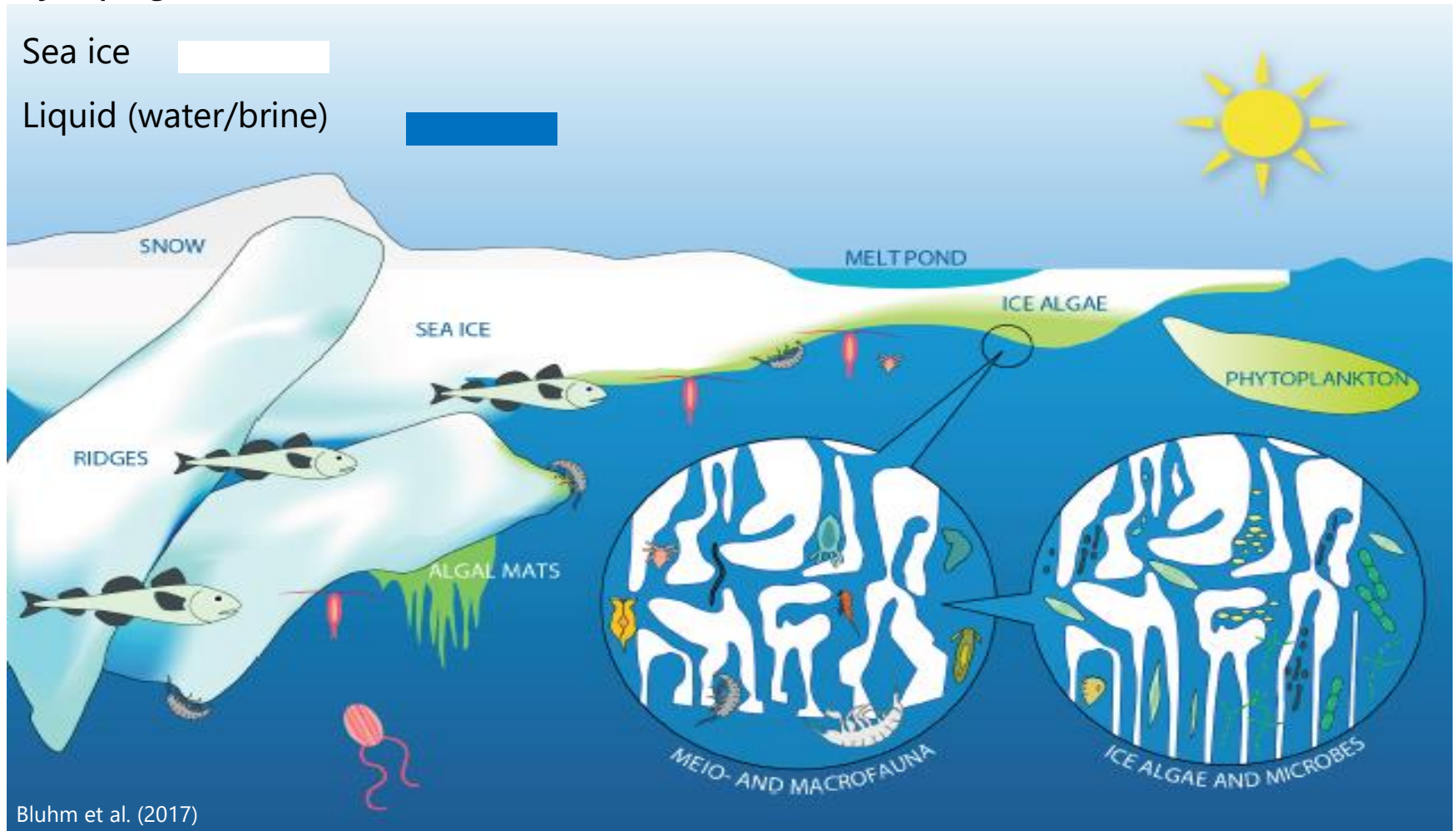
Ecological losers include cold-adapted species that rely on sea ice



How sea ice loss impact the many microorganisms living inside the sea ice is largely unknown

Sea ice biology

Sympagic meiofauna – “ice-associated” animals - 20 to 500 μm



Bluhm et al. (2017)

Sea Ice Algae



picture LA. Melnikov



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Hearts in the Ice – UNIS cooperation

- Frequent sampling of ice cores from February to June to study seasonal colonization and development of algae and tiny animals living inside the sea ice.





Van Keulen March 2021

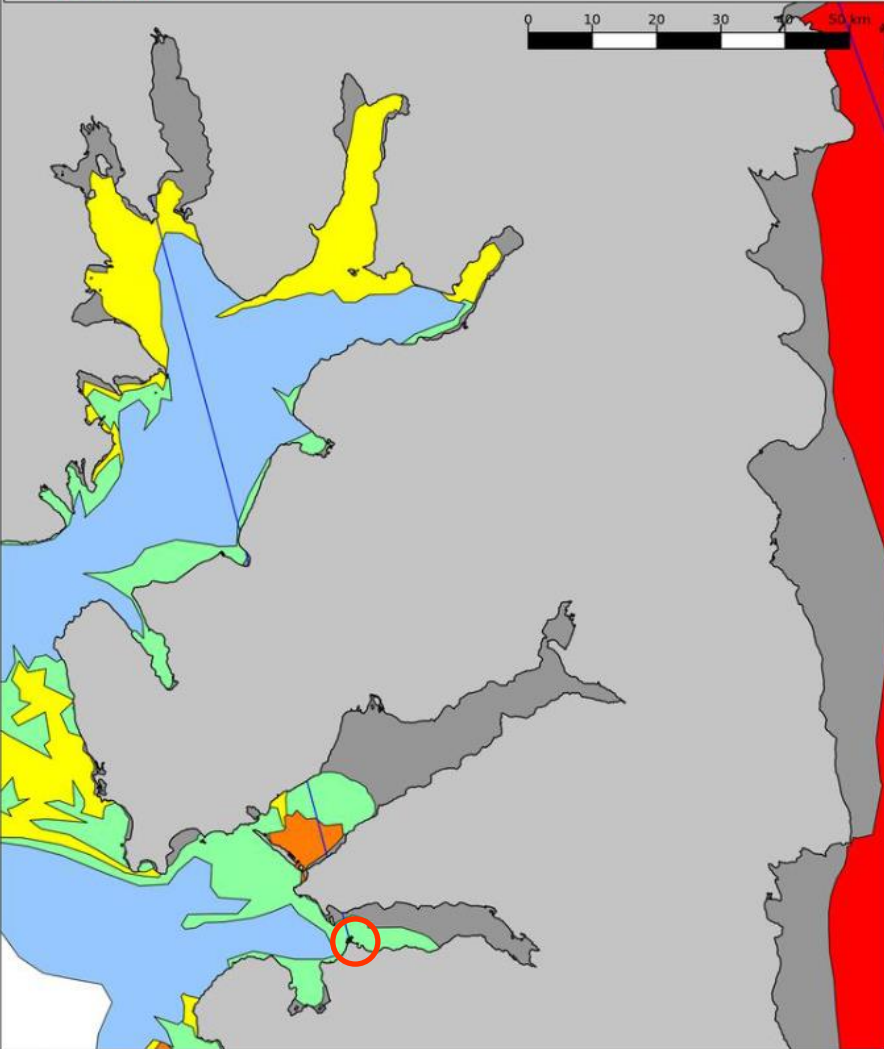


Images by Rebecca Duncan

March sampling









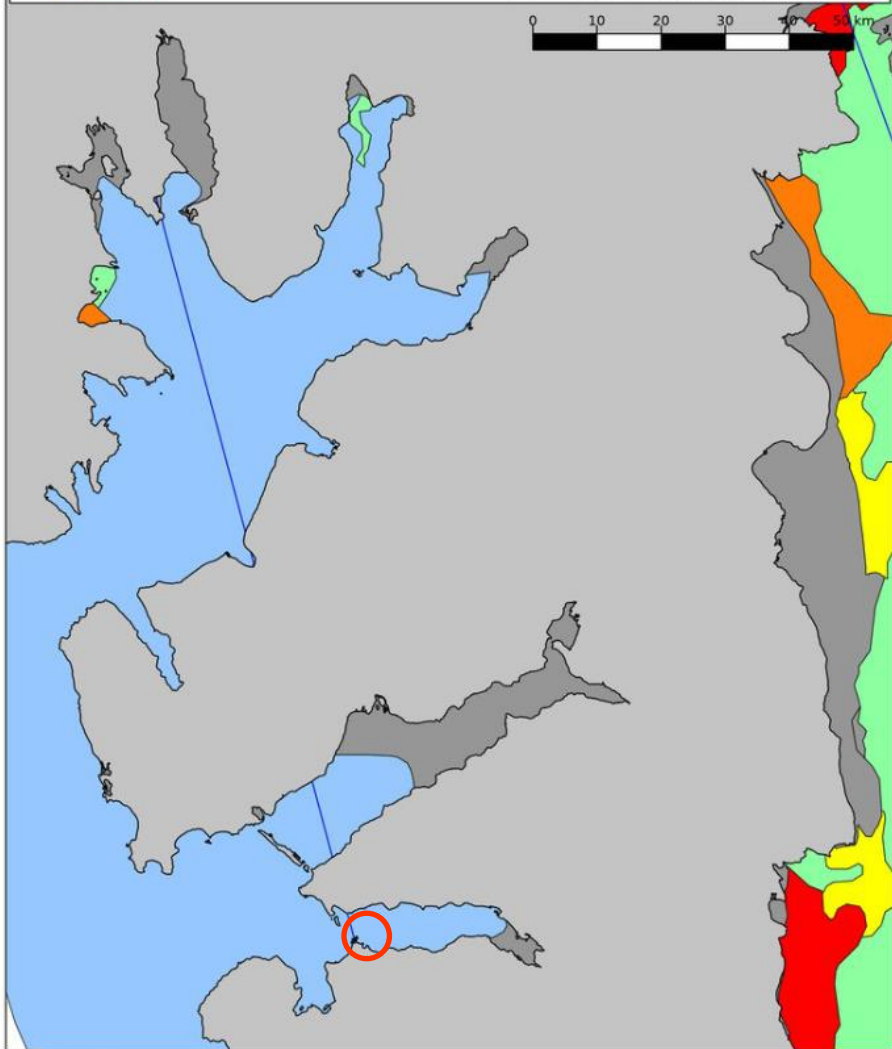


Ice Categories

10/10th	Fast Ice	7-9/10th	Close Drift Ice	1-4/10th	Very Open Drift Ice
4-6/10th	Very Close Drift Ice	4-7/10th	Open Drift Ice	0-2/10th	Open Water

Projection: Polar Stereographic, True Scale at 90°N, WGS84 Scale: 751,029
 Map Corners:
 UL = 79°4'25.256"N, 14°29'46.648"E UR = 78°42' 8.052"N, 20°34'57.123"E
 LR = 77°04'3.117"N, 13°47'25.489"E LL = 77°19'55.929"N, 12°27'21.200"E
 Coastline Data: GSHHS version 2.2.0 (<http://www.seost.hawaii.edu/wessex/gshhs/>)





    **Sea Surface Temperature**



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    **Sea Surface Temperature**



Van Keulen May 2021

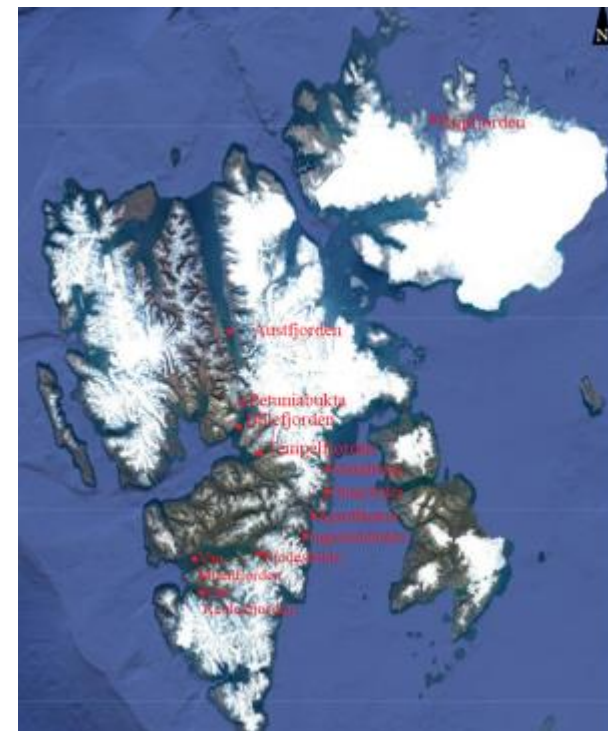
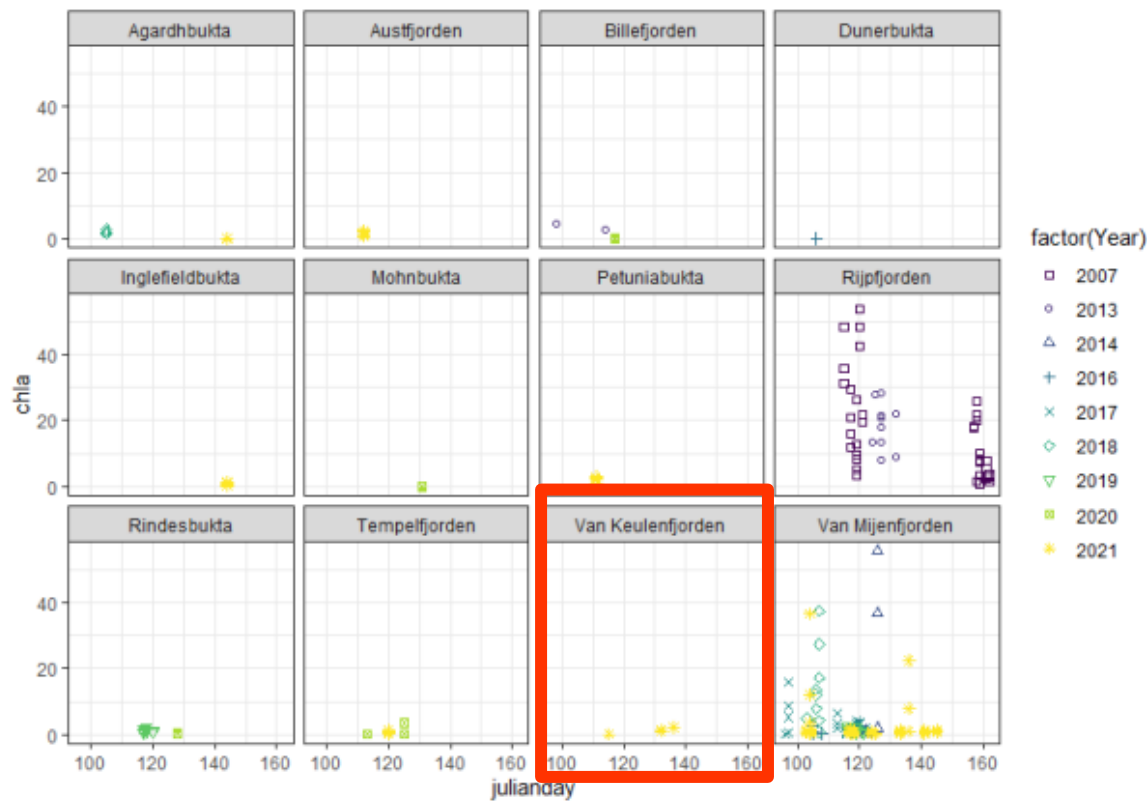


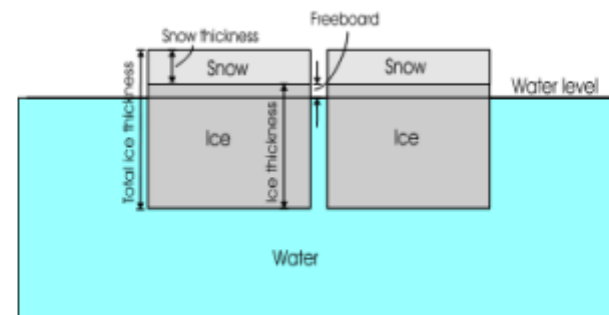
Figure 3.4: Timing and magnitude of algal chl a biomass grouped into respective fjords and according to Julian day (i.e. day of year/date of sampling)

Physical data on:

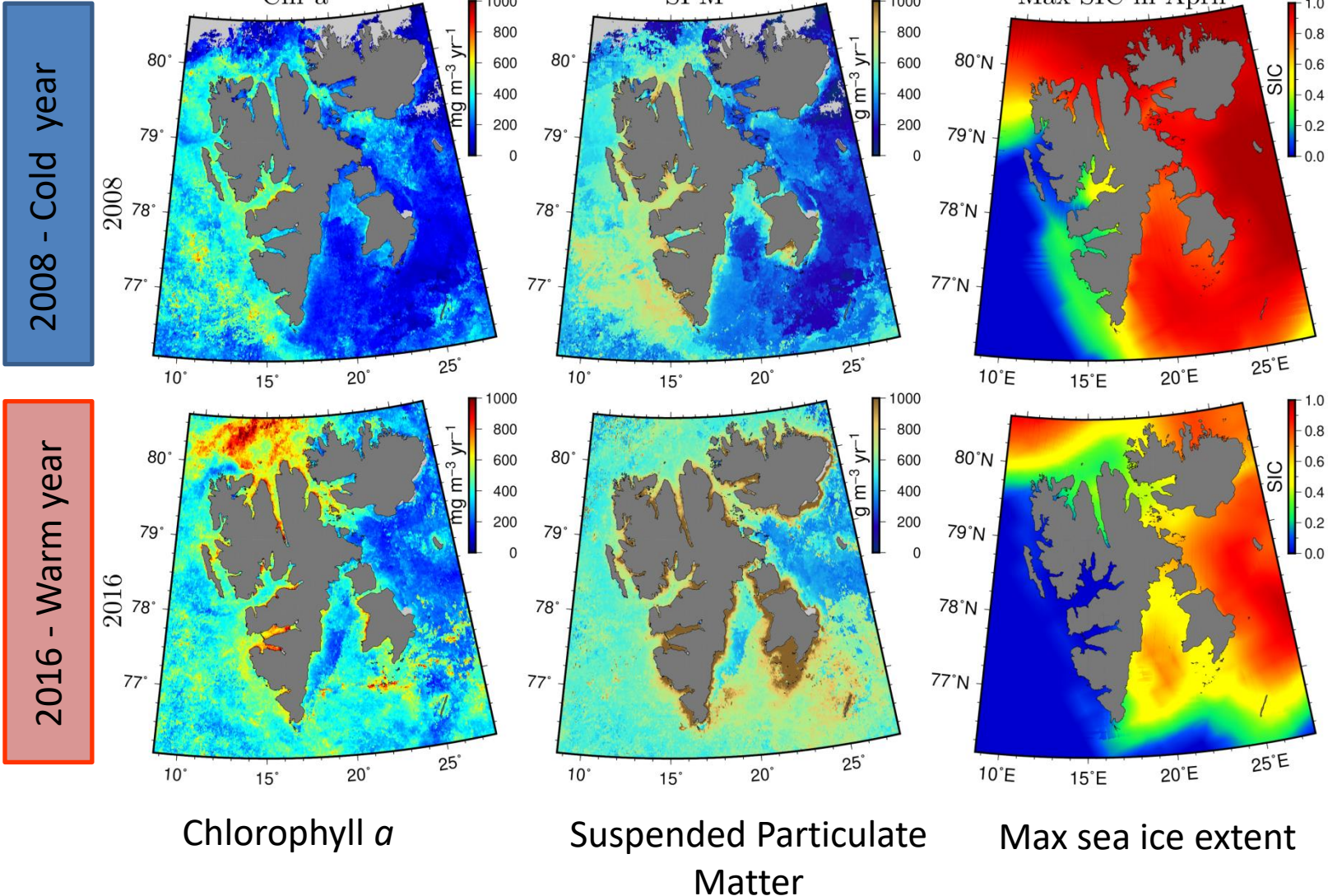
Sea ice thickness

Snow depth

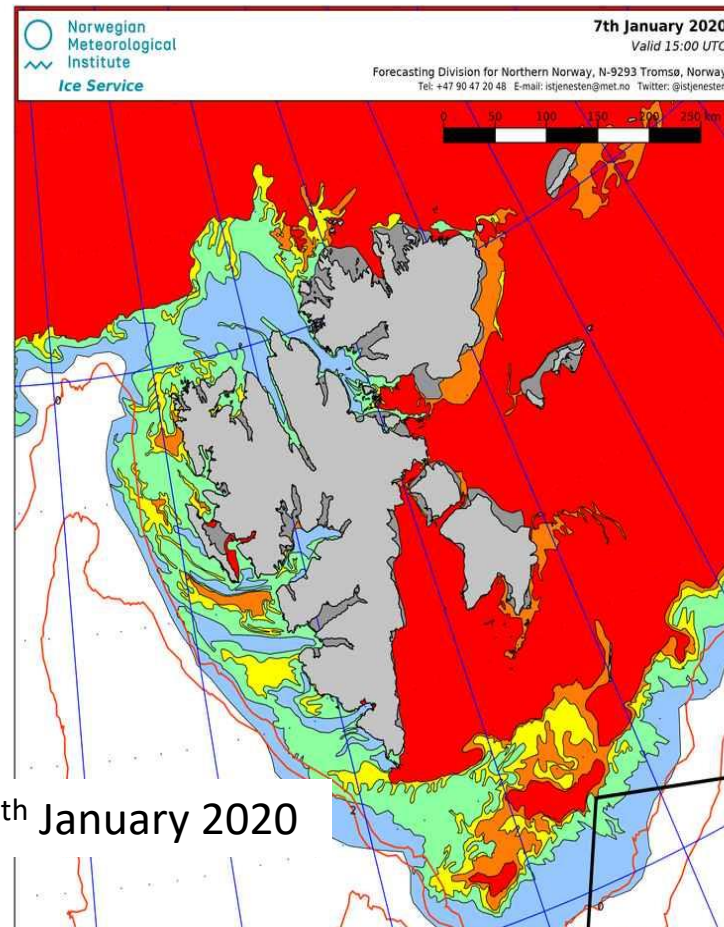
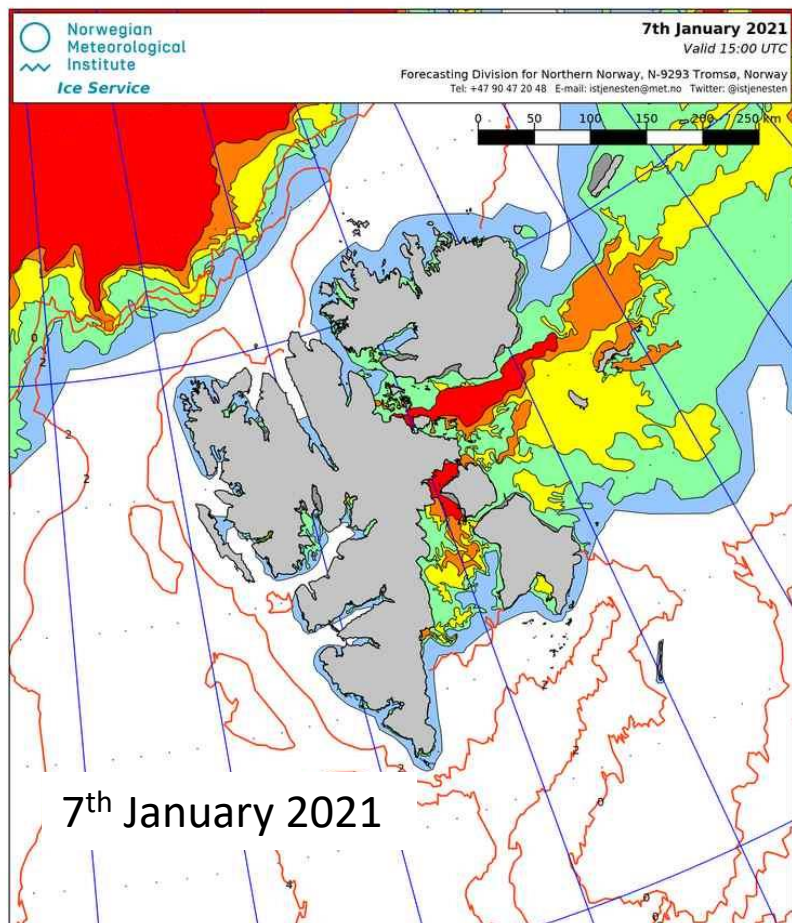
Freeboard



Remote sensing: Important tool for monitoring BUT calibration/validation needed for better precision



The next decade's greatest environmental changes are expected in northeastern Svalbard. Time series from N and E Svalbard important!



Fast ice in Svalbard has strongly decreased the last 30 years ; on average from 5 months sea ice duration to only 1 month (Weslawski et al. 2017)

Citizen science on Arctic cruise ships

(CRUISE#SCIENCE)

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Spatial and temporal sampling in Svalbard

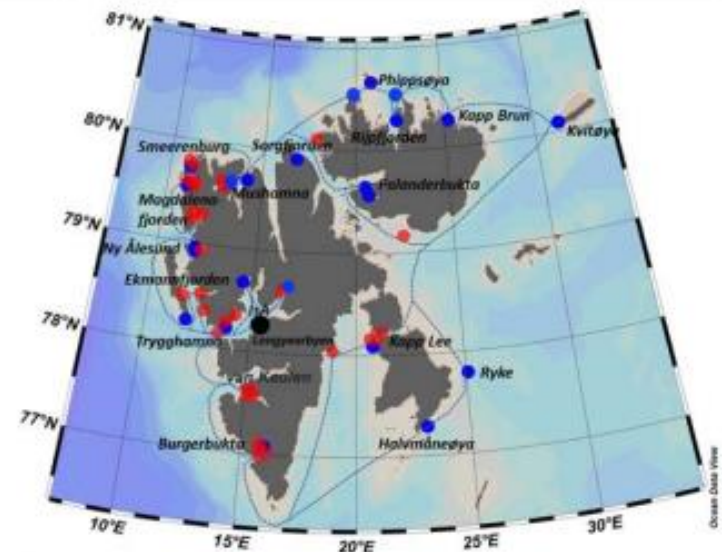


Figure 3. Map of common routes during the 2018 and 2019 trips with Hurtigruten (broken blue lines), and sampling stations in 2018 (blue points) and 2019 (red points)

Water and plankton sampling

3.4 DNA-based analysis of protist and zooplankton communities

DNA extracted from the filtered seawater was sequenced using a metabarcoding approach. In this analysis, a marker gene (in this case either the 18S ribosomal RNA gene or the CO1 barcoding gene) is scanned and compared to a database of sequences belonging to known organisms. The end result is a semi-quantitative overview of which organisms are present in the sample, and thus a measure of biodiversity. The 2018 samples have been processed and sequenced, and the 18 S rDNA data is currently being analyzed. Preliminary results from analyses of the CO1 barcoding gene are shown in Fig. 7. Here it can be seen that the high chlorophyll values observed at Kvitøya were due to a haptophyta bloom (black in Fig. 7), while the late algal community in Smeerenburg was dominated by diatoms (Bacillariophyta, cyan in Fig. 7) and green algae (Chlorophyta, red in Fig. 7). Zooming in we can investigate which organisms are abundant (data not shown). Dominant zooplankton included the copepods *Calanus*, *Pseudocalanus* and especially *Oithona* (Maxillopoda). Barnacles (Maxillopoda) were abundant at some stations in June and July, probably larval stages that drift with the water.



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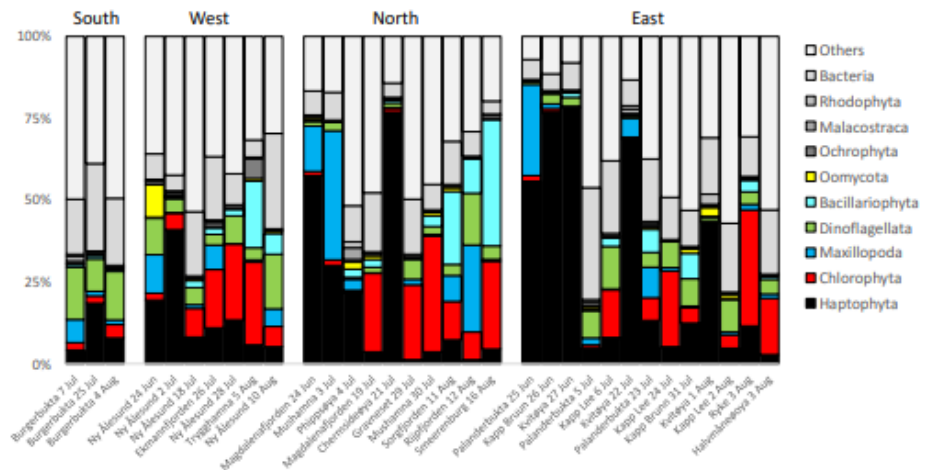


Figure 7. Community composition of protist and zooplankton from the 2018 samples. Stacked bar chart showing the relative gene abundance of the indicated taxonomic groups (mostly phyla), based on metabarcoding of the mitochondrial CO1 gene. The group "others" is made up of various taxonomic groups with low abundance, as well as DNA with uncertain taxonomic assignment. The percentage of each taxonomic group gives us information about the relative abundance of these organisms in the sampled community, and cannot be directly converted to biomass. Such data are linked with the algae biomass and nutrients (Fig. 6) in the different water masses around Svalbard (Fig. 5).



Thanks a lot
to Hearts in
the ice team!

