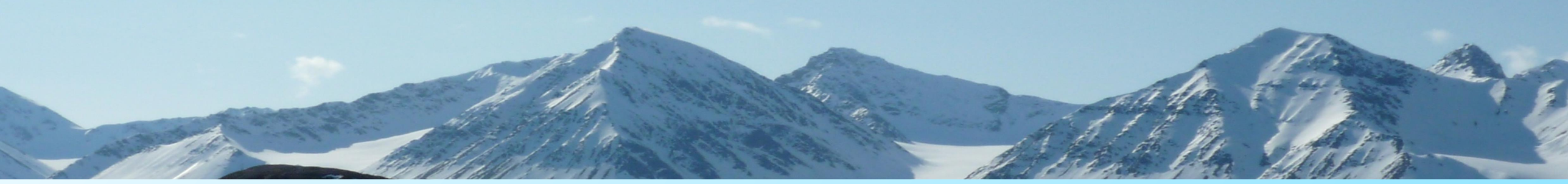
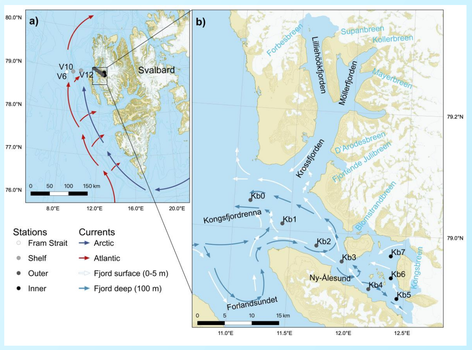


Zooplankton survive the glacial “death trap” in Kongsfjorden - to die another day



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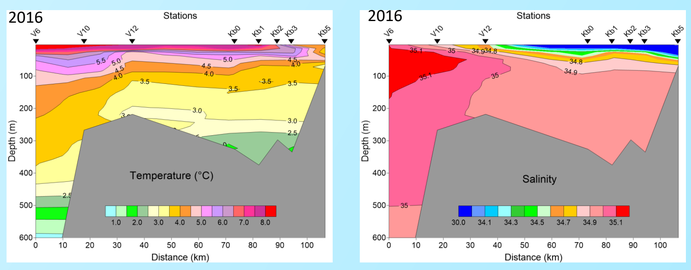
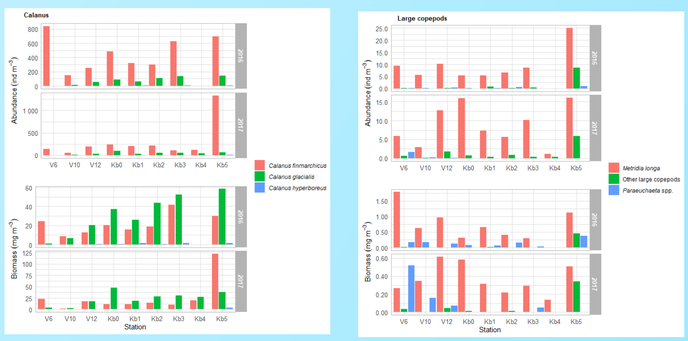
The brown plumes in front of tidewater glaciers in Kongsfjorden contain high concentrations of suspended matter associated with the subglacial discharge of meltwater. As it rises to the surface, the fresh glacial meltwater discharge is mixed with marine water, resulting in constant upwelling and slightly brackish conditions inside the plume. Zooplankton are transported by currents to the inner glacial bay where individuals are exposed to the glacial plumes. This may cause mortality because of osmotic shock. Zajaczkowski & Legezynska (2001) proposed that this “death trap” would remove 15% of the standing stock of zooplankton in the fjord over 100 days. Seabirds are attracted to such plumes to feed on zooplankton and fish.

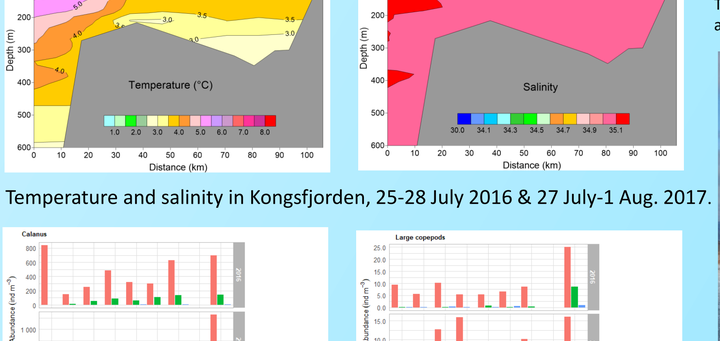
Sampling from RV *Lance* and helicopter in front of tidewater glaciers in Kongsfjorden.



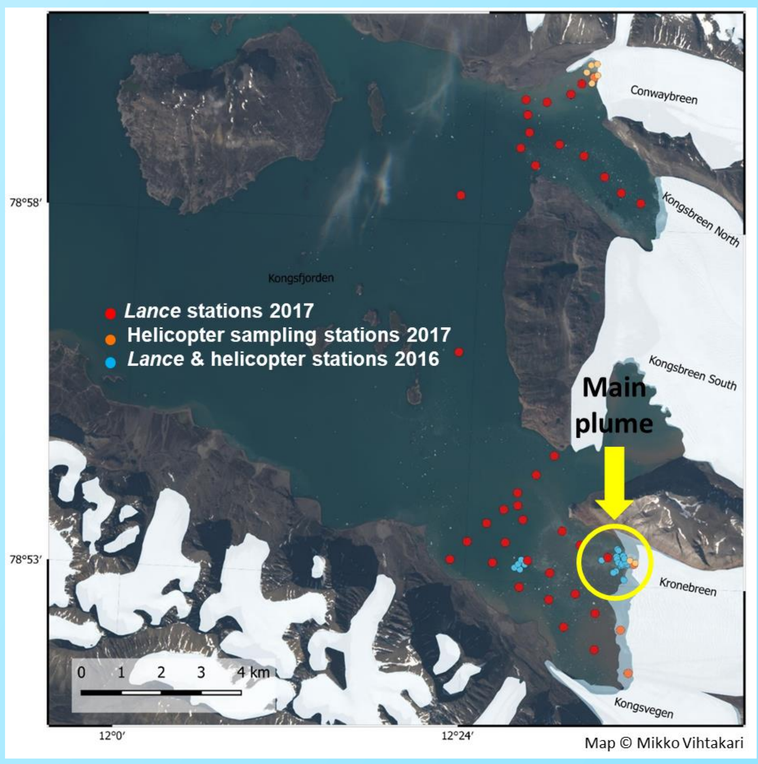
Temperature and salinity in Kongsfjorden, 25-28 July 2016 & 27 July-1 Aug. 2017.



Abundance and biomass of zooplankton increased along the transect from shelf break (V6) to inner fjord (Kb5). This was particularly apparent for *Calanus finmarchicus* and *C. glacialis* and also for some of the other large copepods such as *Metridia longa*, although not *Paraeuchaeta* spp, which showed higher biomass on the shelf.



Abundance and biomass of *Calanus finmarchicus*, *C. glacialis* and *C. hyperboreus* in the inner fjord in the central inner bay, front, and more distant from Conwaybreen, Kongsbreen and Kongsvegen.

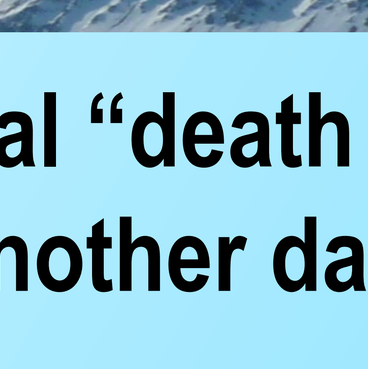


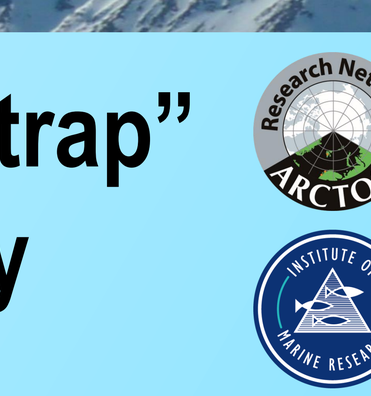
Map © Mikko Vihtakari

Sampling stations by research vessel and helicopter in inner Kongsfjorden, 2016, 2017.
The transparent blue area illustrates the glacier retreat between the sampling campaigns in early August 2016 and late July 2017. The glacier area of Kongsvegen and Kronebreen has decreased by 1.4 km².

The 30 m tall glacial front of Kronebreen with brown glacial plume.

Black-legged kittiwakes feeding on zooplankton and juvenile fish in the brown plume.
Photo: Sky Camera team (2017)





Abundance of alive and dead zooplankton sampled inside and outside the glacial plume with WP2 and WP3 nets sampled from helicopter in July 2016. The abundance in WP2 constituted mainly smaller copepod species and *Calanus* spp. Most abundant zooplankton in WP3 included *Calanus glacialis* and *C. finmarchicus,* amphipods, krill and arrow worms (chaetognaths).

Neutral red stain was added to separate alive and dead zooplankton, since only live animals take up the stain. As can be seen in the petri dish, most zooplankton were alive, and only few (<5%) were considered dead in samples. Elevated concentrations (<6 mg m^{-3}) of dead zooplankton trace the glacial discharge plume.

Key insights from study:

1. Concentrations or mesozooplankton species in Kongsfjorden increased towards the inner glacial bay, and were high at most stations in the inner bay.
2. The percentage of dead zooplankton in samples from the proposed “death trap” was <5%, which is within the non-consumptive mortality range reported for zooplankton samples during spring and summer.
3. Slightly elevated mortality of zooplankton inside the plume continuously maintained for the entire glacier run-off season (~100 days) supports a flux fresh organic matter in glacial bays feeding abundant benthic amphipods.
4. This glacial elevator makes the zooplankton more easily accessible to surface foragers, such as black-legged kittiwakes and Arctic terns, which often feed inside the glacier plume. Thus, predation is likely a main cause of mortality.

Zajaczkowski, M. & Legezynska, J. (2001) Estimation of zooplankton mortality caused by an Arctic glacial outflow. *Oceanologia* 43, 341–351.

/ THE PROPOSED OSMOTIC “DEATH TRAP” FOR ZOOPLANKTON IN THE INNER GLACIAL BAY OF KONGSFJORDEN IS

HOWEVER, INCREASED MORTALITY BECAUSE OF FACILITATED SEABIRD FEEDING IN THE GLACIAL PLUME IS