Sedimentary organic matter sources, benthic consumption and burial in west Spitsbergen fjords – signs of warming induced maturing of high latitude fjordic systems?

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Manuskrypt złożony w redakcji Journal of Marine Systems
Special Issue „Ecology of Northern Fjords” ed. Torstein Pedersen
w lutym 2016

HYPOTHESIS:

Warming will induce maturing of high latitude fjords in terms of organic matter biological mineralization and burial in sediments.

Mature ecosystems sequester little organic carbon (Corg) in sediments as the complex and effective food webs consume most of available organic matter within the water column and sediment, in contrast to young systems, where large proportion of Corg is buried in deeper sediment layers (e.g. Odum 1969).

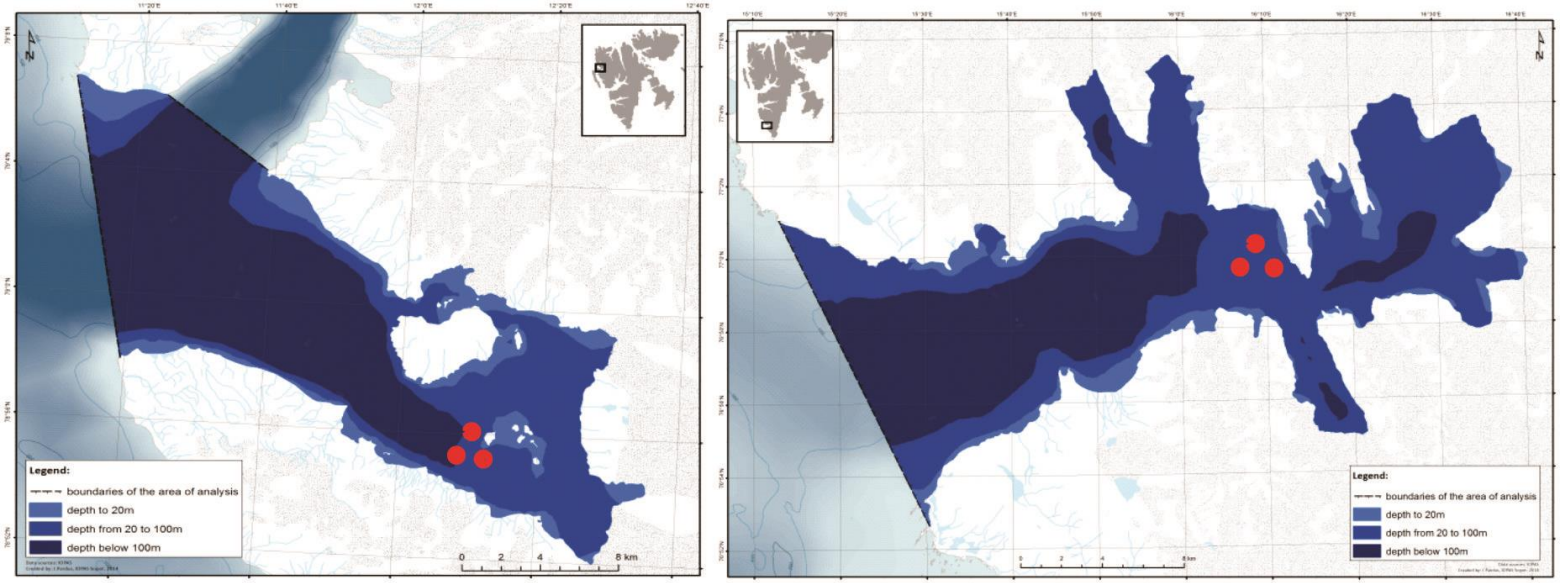
AIMS/SCIENTIFIC QUESTIONS:

- Do sedimentary Corg pool and sources, accumulation rate in sediments differ between the fjords?

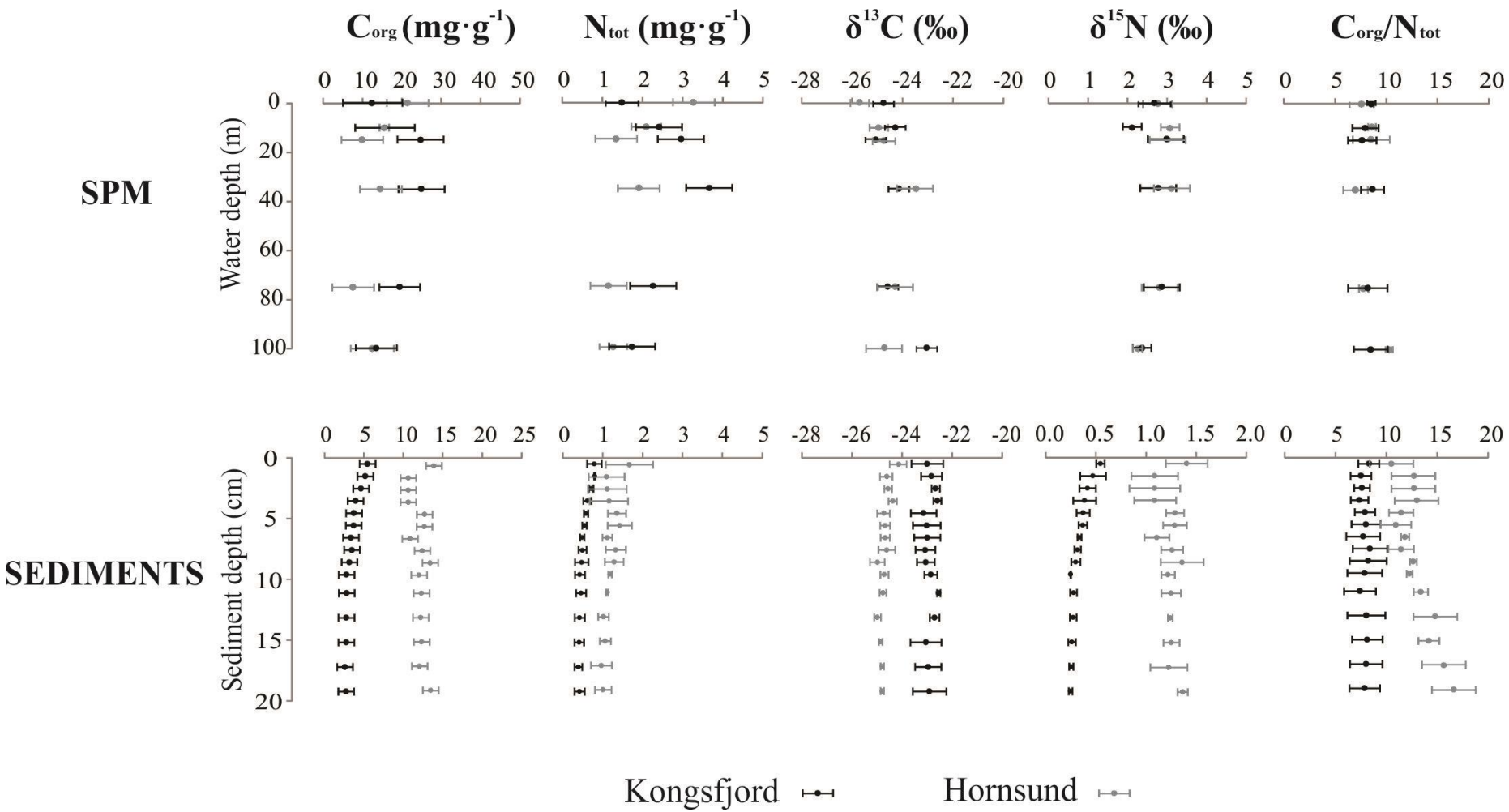
- Do the differences in sedimentary Corg characteristics (benthic food quantity and quality) effect the macrobenthic communities (composition, diversity, standing stocks, carbon demand)?

- Is the carbon burial lower in a warmer fjord?

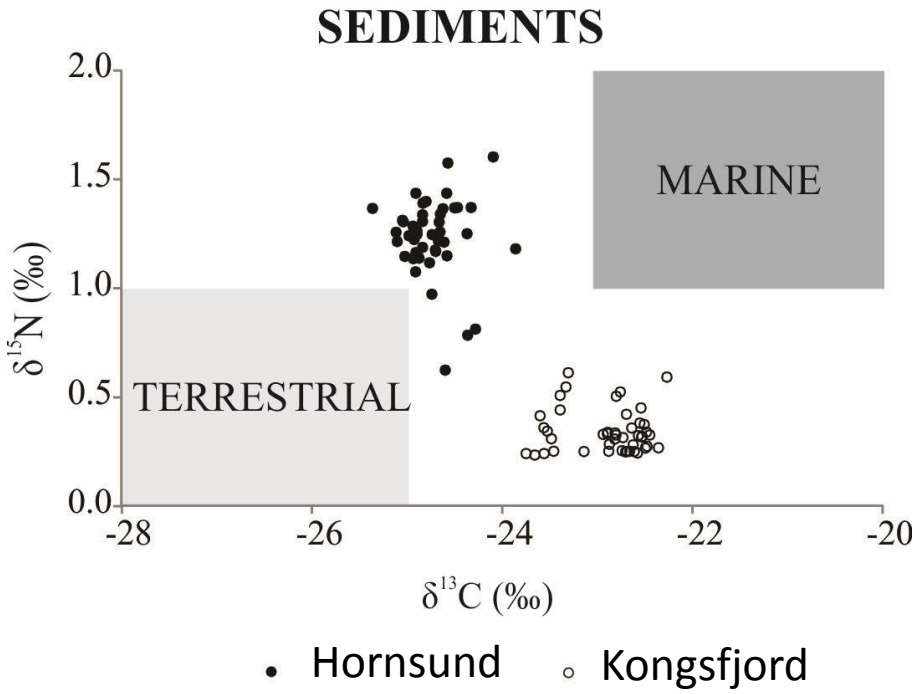
SAMPLING STATIONS



SPM and sediments



Sedimentary OM sources

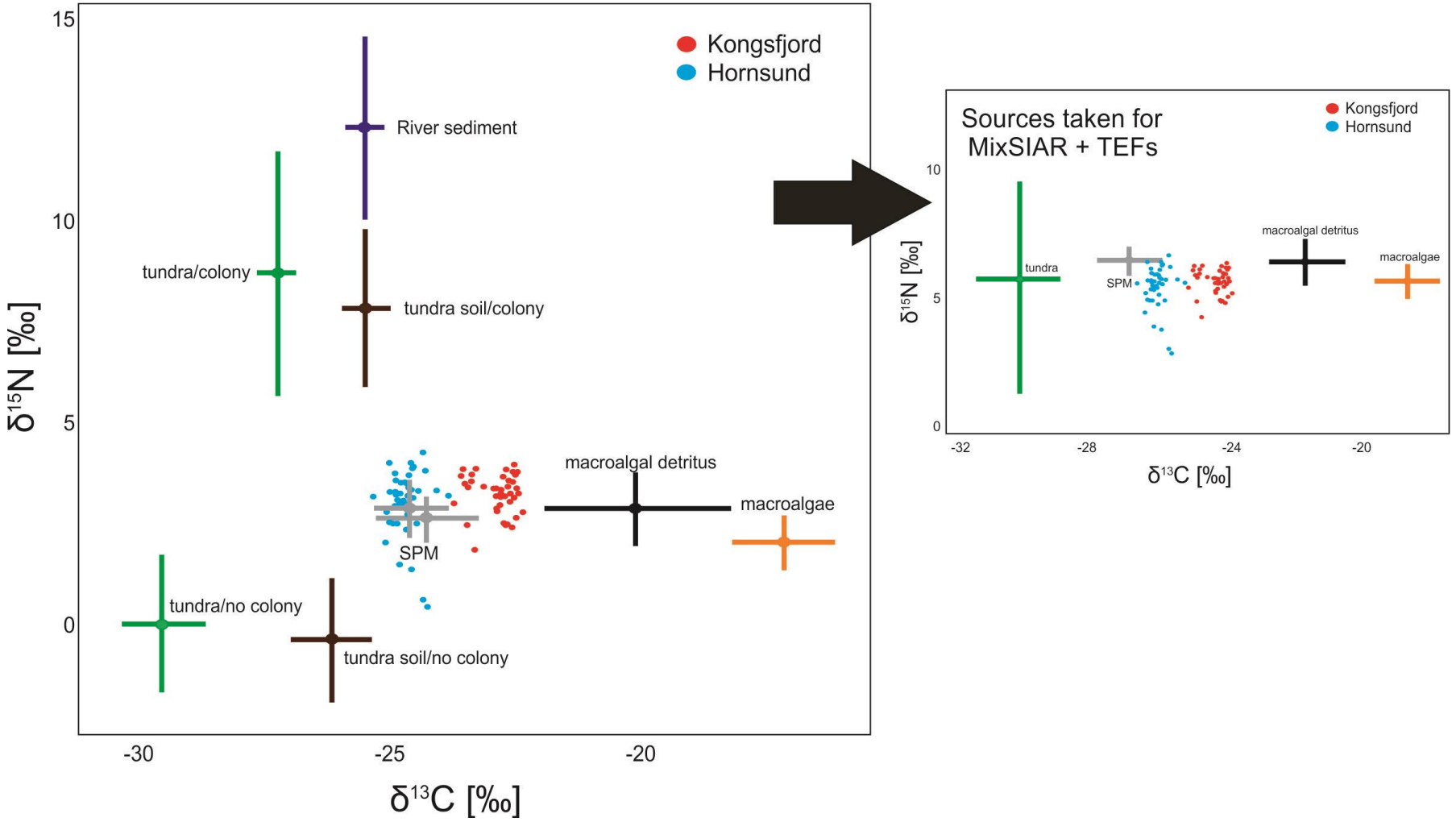


END-MEMBERS METOD

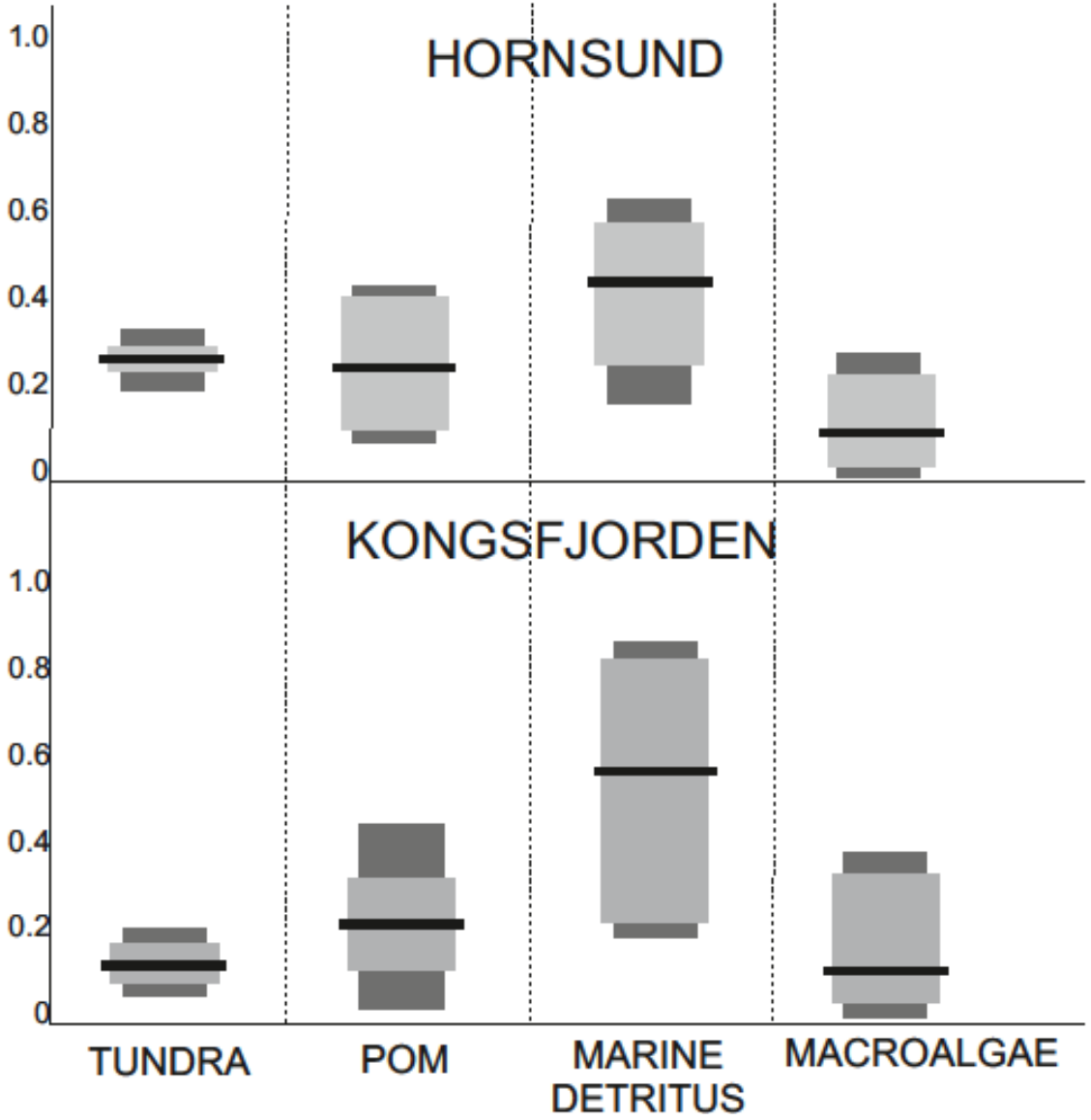
KGF - 20-40% C_{org} – terrestrial origin

HSD - 50-70% C_{org} - terrestrial origin

Sedimentary OM sources



Sedimentary OM sources

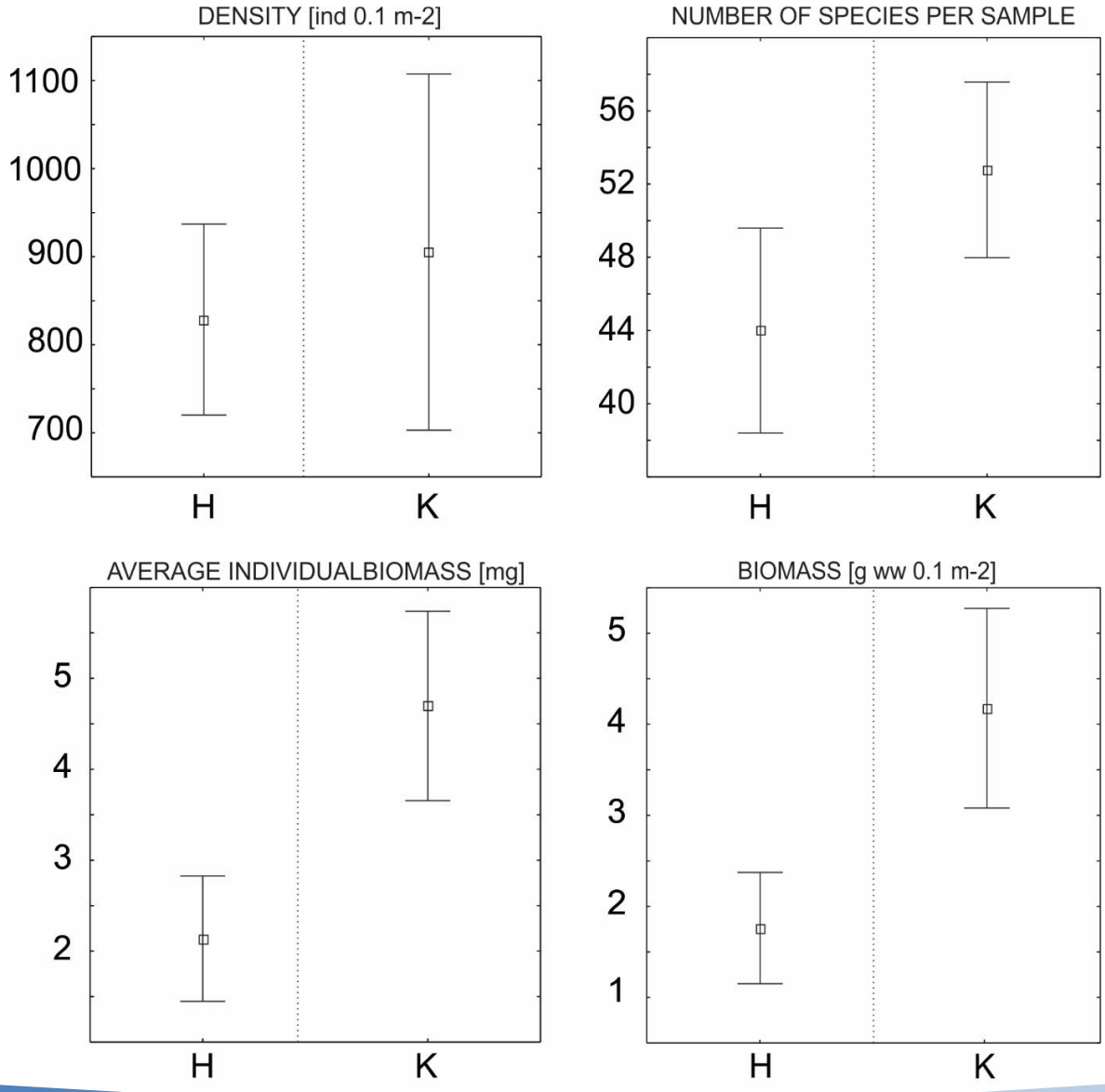


BAYESIAN METHOD
MIXSIAR modelling

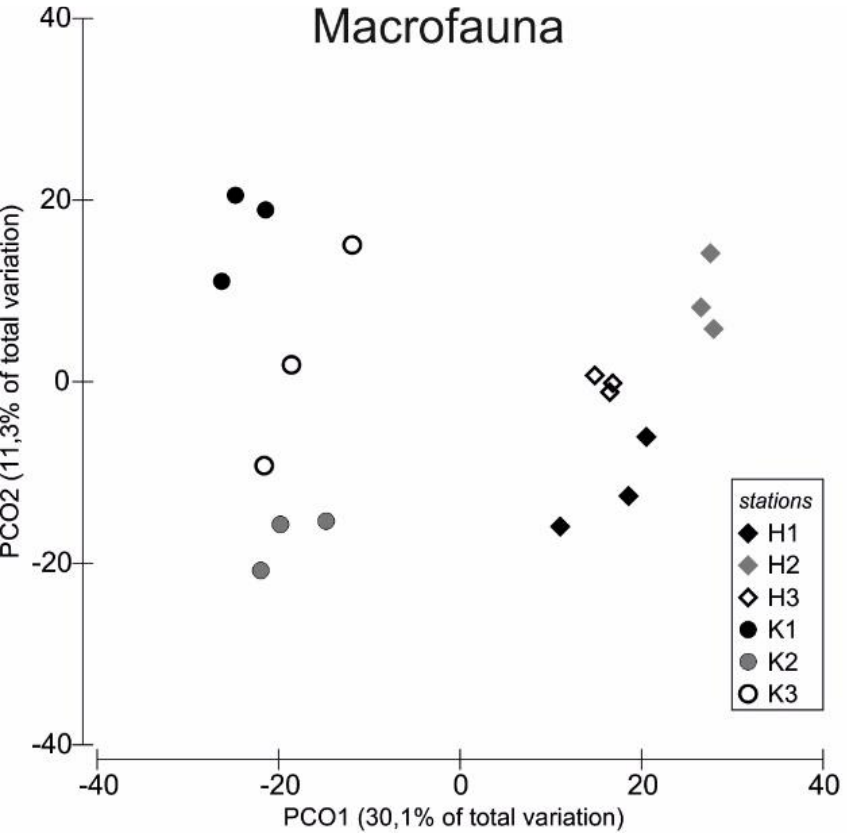
tundra
HRS (18-33%) >KGF (1-20%)

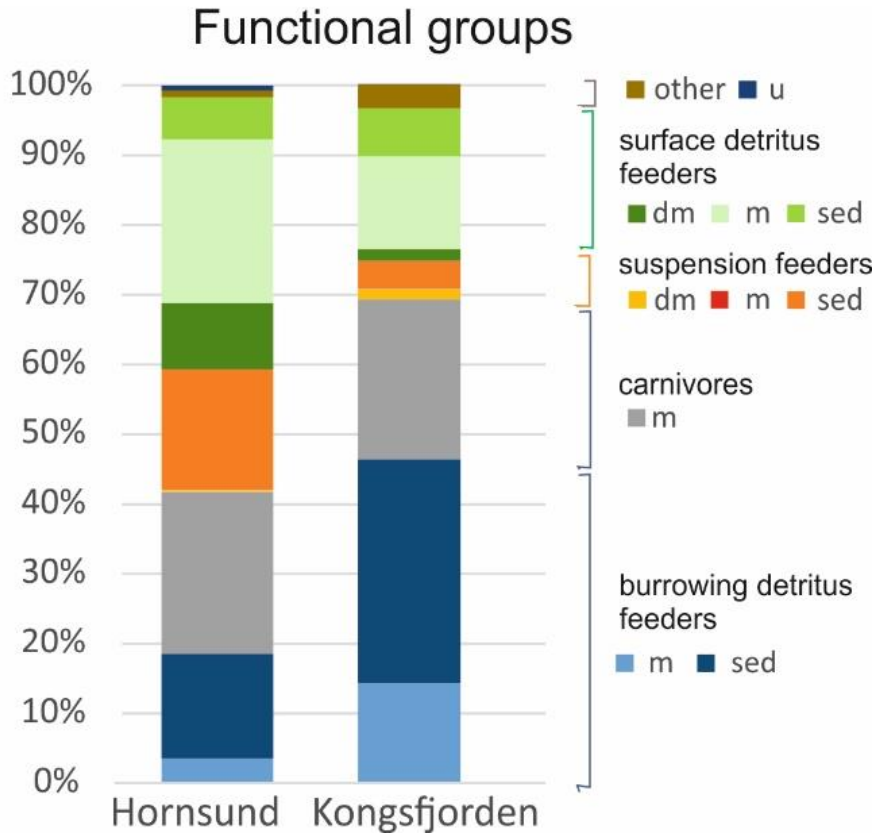
macroalgal detritus
KGF (15-87 %) >HRS (15-61 %)

Macrozoobenthos – diversity, standing stocks

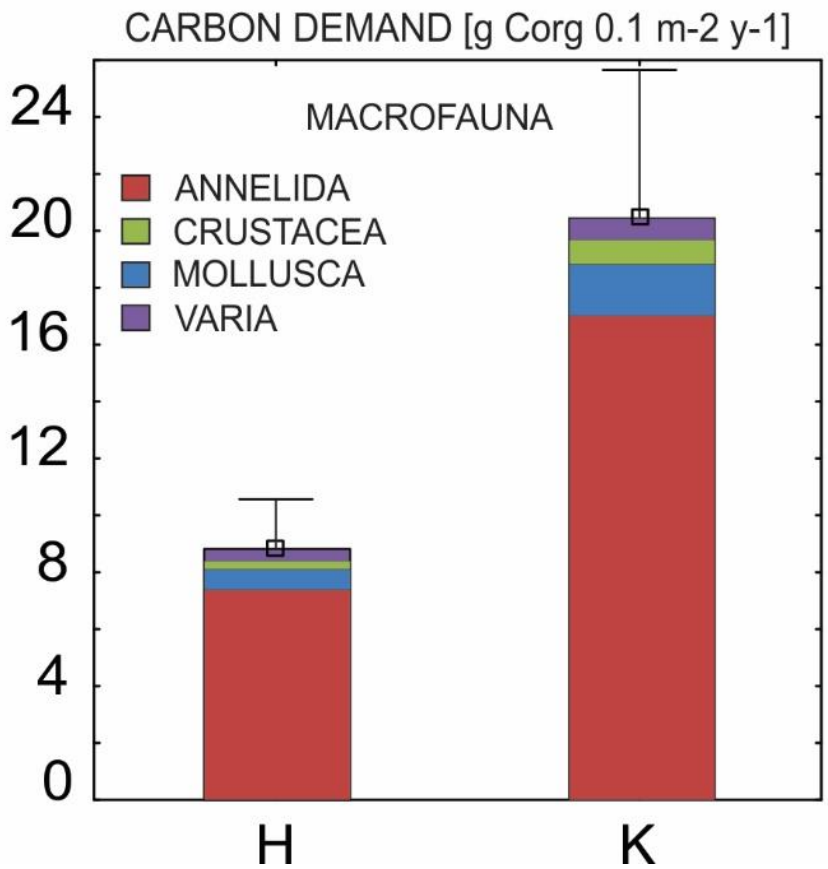


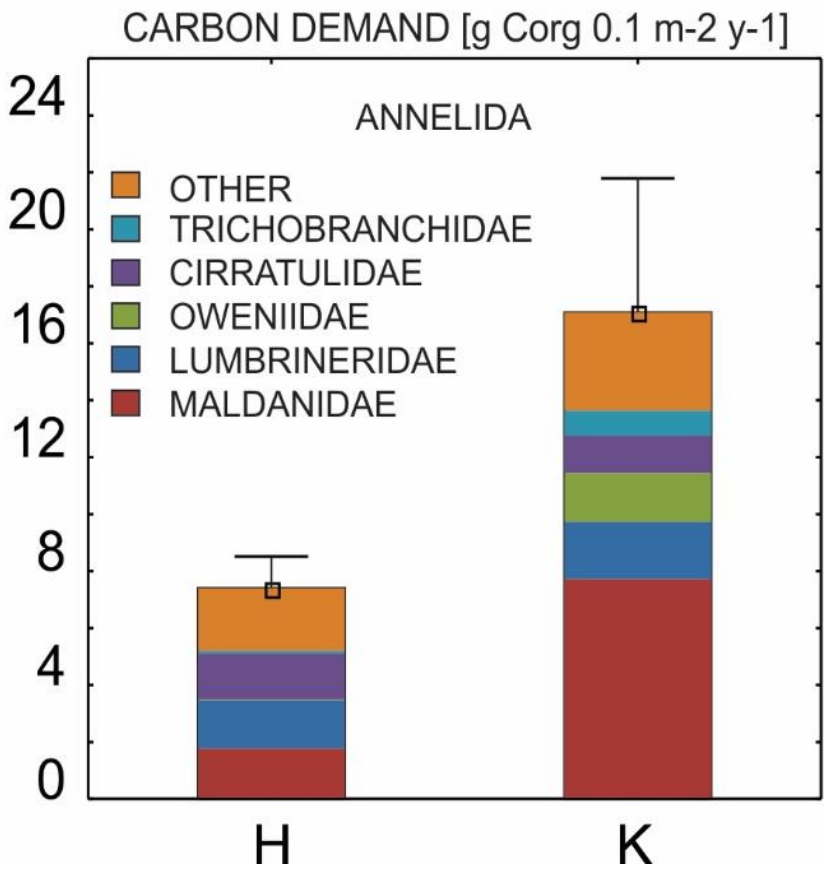
Macrozoobenthos - composition





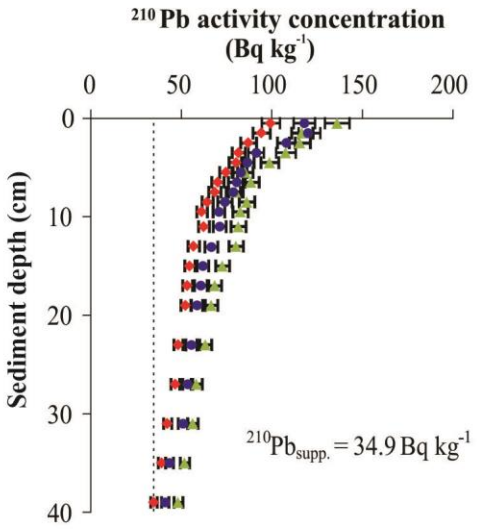
Macrozoobenthos – carbon demand

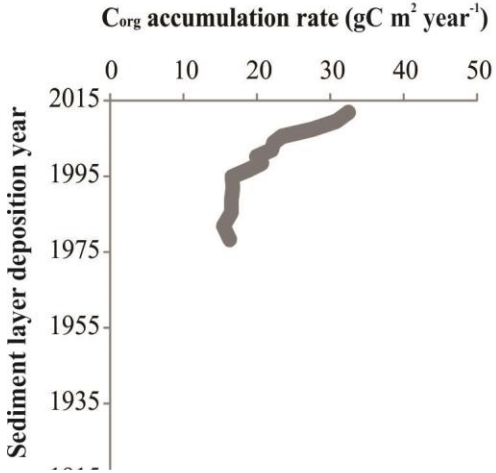




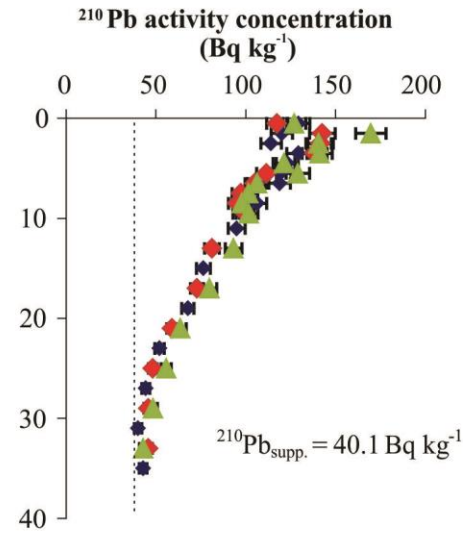
Sediment and C_{org} accumulation rate

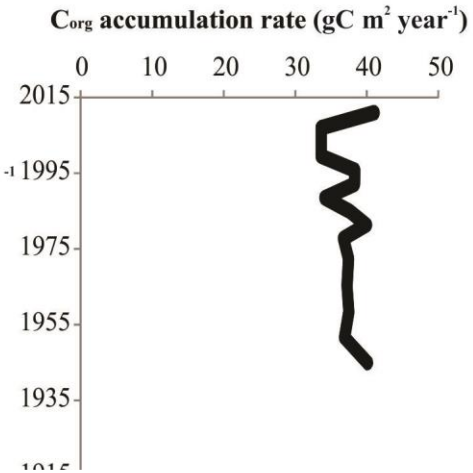
KONGSFJORD





HORNSUND





Station	LAR (cm year^{-1})	MAR (kg m^{-2} year^{-1})
H G1	0.24±0.02	2.9±0.6
H G2	0.23±0.02	3.3±0.6
H G3	0.22±0.03	2.9±0.6
K G1	0.38±0.04	5.4±0.5
K G2	0.41±0.05	6.3±0.6
K G3	0.40±0.06	6.1±0.6

Organic Carbon Burial

Organic carbon burial in deeper sediments (<20cm depth):
*(MAR * Corg in 20-22cm)*

Kongsfjord - 15.4 to 15.9 g m^{-2} y^{-1}
Hornsund - 35.5 to 38.6 g m^{-2} y^{-1}

% of C_{org} reaching the bottom buried in the deeper layers

Kongsfjord 45-53%
Hornsund 84-92%

warming of the high latitude fjordic environments may induce maturing of the sea bottom systems, in terms of development of stable, biologically accommodated benthic communities more efficiently mineralizing organic matter and consequent lower sequestration of organic matter in deeper sediments.