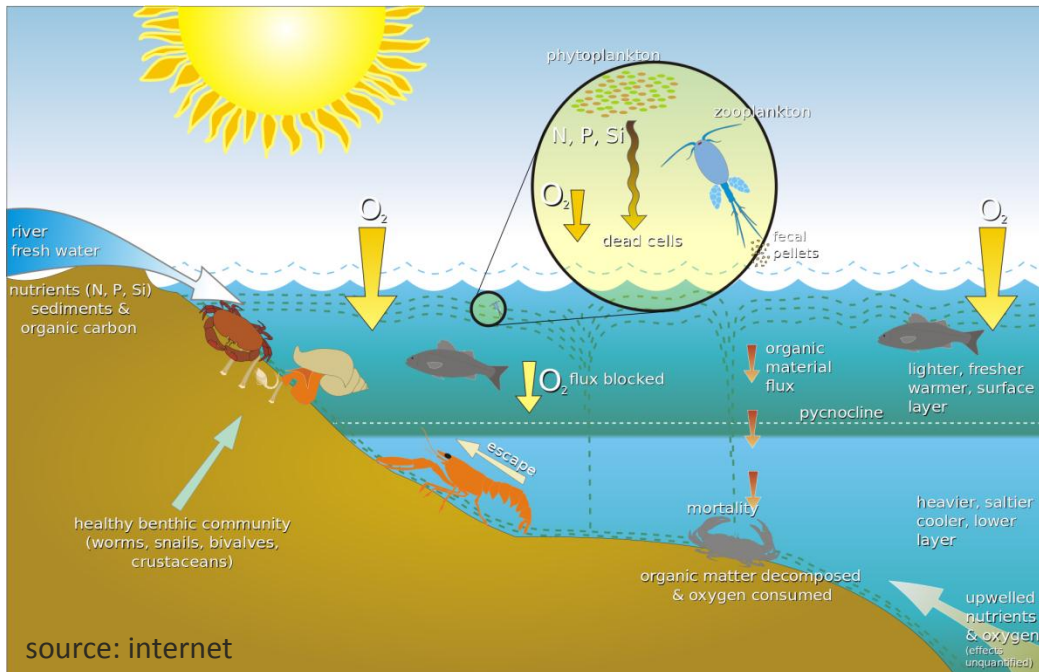


TOTAL BENTHIC OXYGEN UPTAKE in two Spitsbergen Arctic fjords under different hydrological regimes



by Kotwicki L., Grzelak K., Opalinski K., Weslawski J.M. et al.

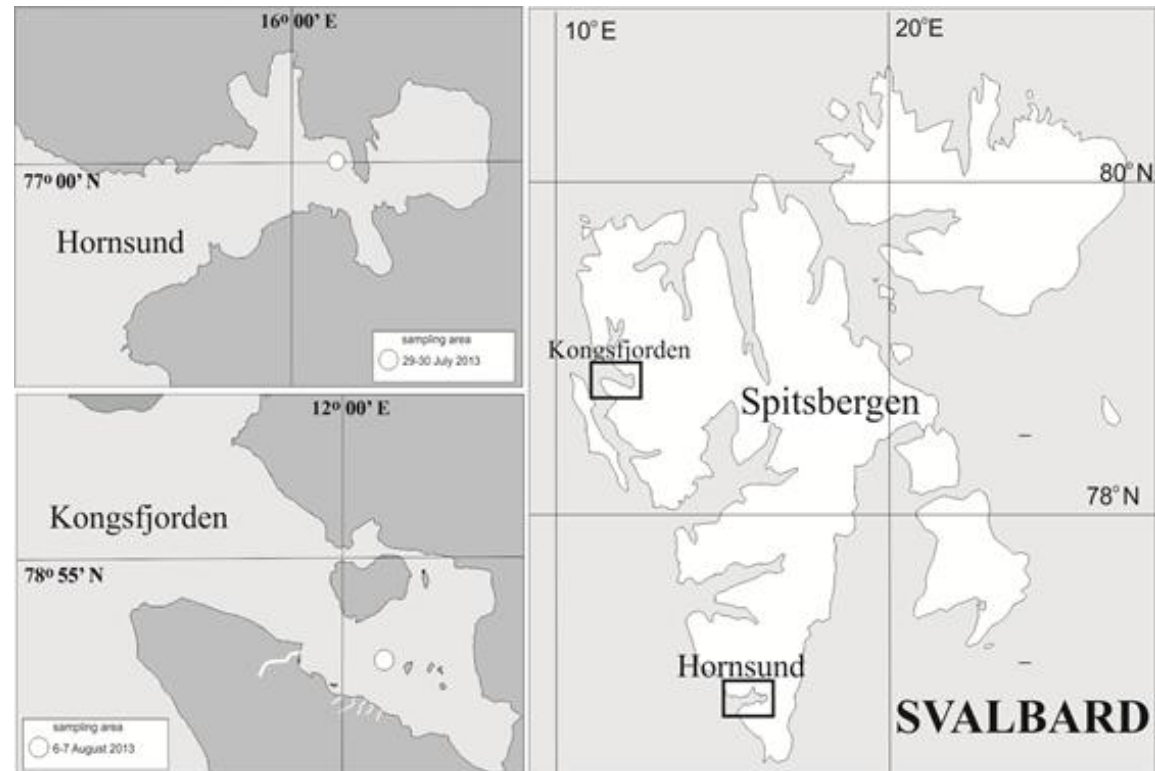
- Plexiglass cores, with a 100 cm² surface and containing approximately 15 cm of overlying water
- Lids with O-ring were equipped with electric steering motor
- The chambers were maintained in the dark condition and in situ temperature, during which oxygen concentration was measured over periods of about 50 hours.
- Six replicate incubations were made in each area.



incubations of
surficial sediments
and bottom water
within chambers

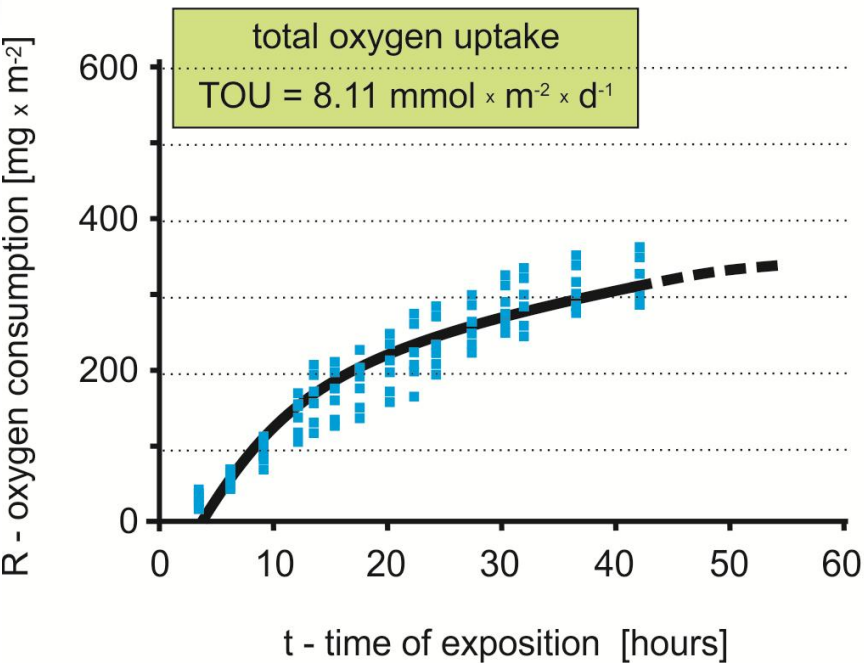
Working questions:

1. What is the oxygen consumption by the sediment in environmentally different fjords?
2. How the oxygen uptake values are related to the meio- and macrofaunal communities?
3. How it is related to the biogeochemistry? of sediments and microbial activity?
4. How differences in pelago-benthic coupling – sedimentation of organic and mineral material - are influencing the process?

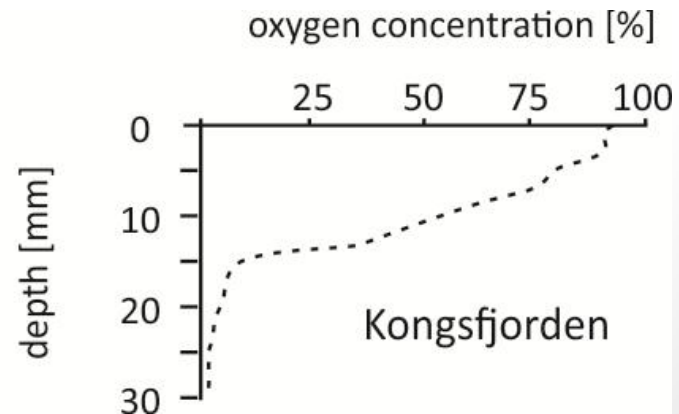
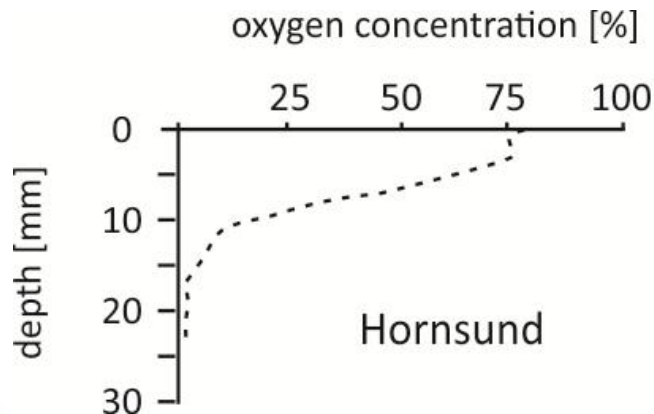
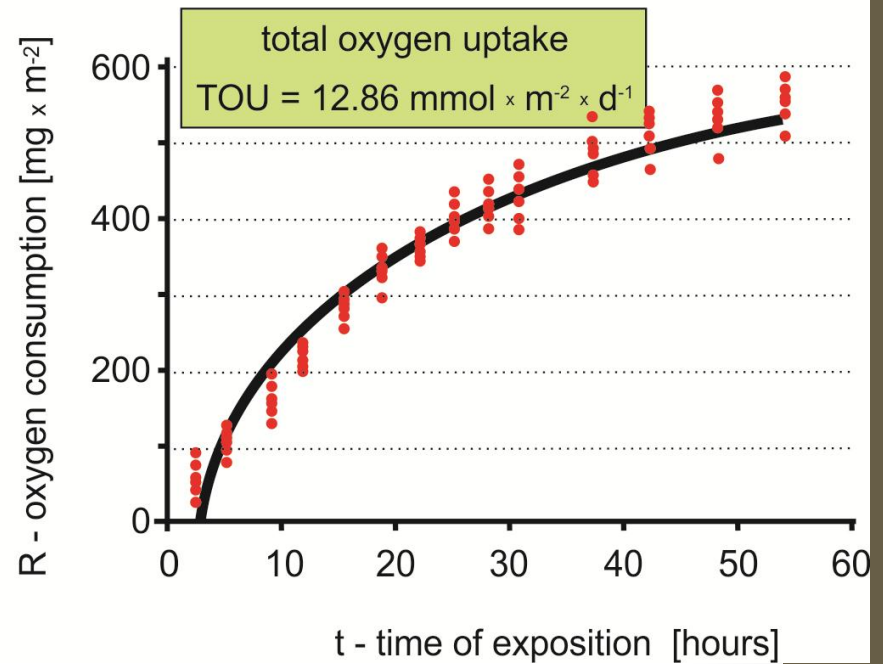


1. What is the oxygen consumption by the sediment in environmentally different fjords?

HORNSUND



KONGSFJORDEN



Summary of previous benthic total oxygen uptake rates from the Arctic fjords of Svalbard archipelago

region	water depth [m]	method	oxygen uptake rate [mmol m ⁻² d ⁻¹]	source
eastern Svalbard	200-300	core incubation	3.2 – 11.9	Pfannkuche & Thiel (1987)
Svalbard around	170-2577	core incubation	1.85 – 11.2	Hulth et al. (1994)
Kongsfjorden	326	core incubation	9.33	Hulth et al. (1994)
Hornsund, Bellsund	115-155	sediment incubation	1.13 – 1.58	Kostka et al. (1999)
Hornsund	100	core incubation	8 - 9	this study
Kongsfjorden	100	core incubation	12 - 13	this study

2. How the oxygen uptake values are related to the meio- and macrofaunal communities?

area	biomass wet weight [g m ⁻²]		oxygen consumption rates [mmol m ⁻² d ⁻¹]	
	macrofauna	meiofauna	macrofauna	meiofauna
Hornsund	crustacea: 0.00 polychaeta: 3.12 mollusca: 2.16 varia: 0.12 total: 5.40	total: 0.57 94 % of nematodes	0.056 0.7 % of total O ₂ uptake	0.45 5.5 % of total O ₂ uptake
Kongsfjorden	crustacea: 3.6 polychaeta: 32.6 mollusca: 25.7 varia: 3,7 total: 65.7	total: 0.42 95 % of nematodes	0.91 7.8 % of total O ₂ uptake	0.50 3.89. % of total O ₂ uptake

Meiofaunal respiration was estimated using the function of Grant and Schwinghamer (1987) $R=2.90V^{0.80}$ where V is a total meiofaunal biovolume. For estimation of macrofaunal respiration we have used biomass of major taxa and the mass-specific metabolic rates given by Piepenburg et al. (1995).

3. How it is related to the microbial activity?

	oxygen uptake [mmol m ⁻² d ⁻¹]			
	total	meiofauna	macrofauna	bacteria + diffusive transport of O ₂
Hornsund	8.11 100%	0.45 5.5%	0.06 1%	7.6 93,5%
Kongsfjorden	12.86 100%	0.5 4%	0.9 8%	11.46 88%

3. How it is related to the microbial activity?

	bacteria production* [$\mu\text{g C cm}^{-3} \text{ h}^{-1}$]	total bacteria number (TBN)** [$10^{-9} \text{ cell cm}^{-3} \text{ d.m.}$]	bacteria biomass [g C m^{-2}]
Hornsund	0.185 \pm 0.055	3.39	1,56
Kongsfjorden	0.313 \pm 0.044	4.27	2,16

* Ameryk et al. data – GAME project

** Jankowska et al. data – GAME project

4. How differences in pelago-benthic coupling – sedimentation of organic and mineral material - are influencing the process?

	Hornsund	Kongsfjorden	reference
Primary production	120	60	Smoła et al. 2016
Carbon accumulation rate	38-42	29-35	Zaborska et al.
Carbon burial	35-39	15-16	Zaborska et al.
meiofauna carbon demand	1.68	1.86	this study
macrofauna carbon demand	0.44	7.13	this study
microbial carbon demand	49.5	77.5	this study
total benthic carbon demand	51.62	86.49	this study

Working questions:

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4. How differences in pelago-benthic coupling – sedimentation of organic and mineral material - are influencing the process?

1. Total Oxygen Uptake (TOU) rates on the NW Spitsbergen shelf in Kongsfjorden were above 50% higher than those in the Hornsund area.

2. Meio- and macrofauna contribute roughly 7-12 % of the TOU in both sites.

3. Oxygen uptake of the microbial community (e.g. bacteria, protozoa) corresponded to more than 80 % of TOU.

4. Kongsfjorden is heterotrophic, as only some 50% of benthic carbon demand is covered by local primary production, while in Hornsund primary production in water column exceeds benthic carbon demand.