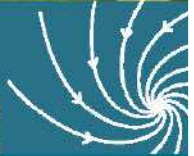


WWW.BJERKNES.UIB.NO

Bjerknes Centre  
for Climate Research



# Arctic ecosystem net community production response to increasing ocean acidification

**Anna Silyakova** <sup>(1,2)</sup>, Richard Bellerby <sup>(1,2,3)</sup>, Gisle Nondal <sup>(1,2)</sup>, Tor De Lange <sup>(2,3)</sup>, Jan Czerny <sup>(4)</sup>, and Kerstin Nachtigall <sup>(4)</sup>

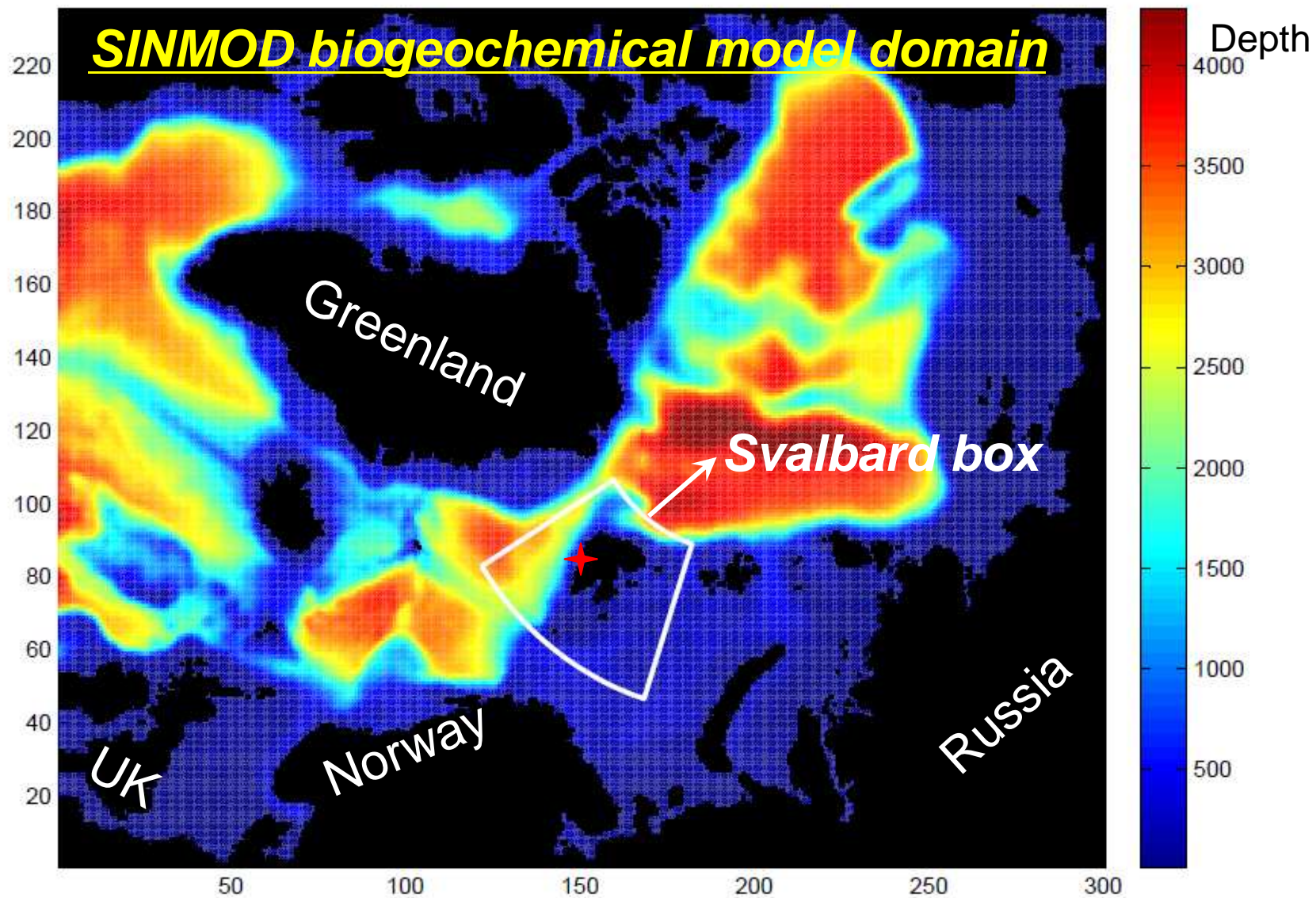
<sup>1</sup>Uni Bjerknes Centre, Allégaten 55, N-5007 Bergen, Norway

<sup>2</sup>Bjerknes Center for Climate Research, Allégaten 55, 5007 Bergen, Norway

<sup>3</sup>Geophysical Institute, University of Bergen, Allégaten 70, 5007 Bergen, Norway

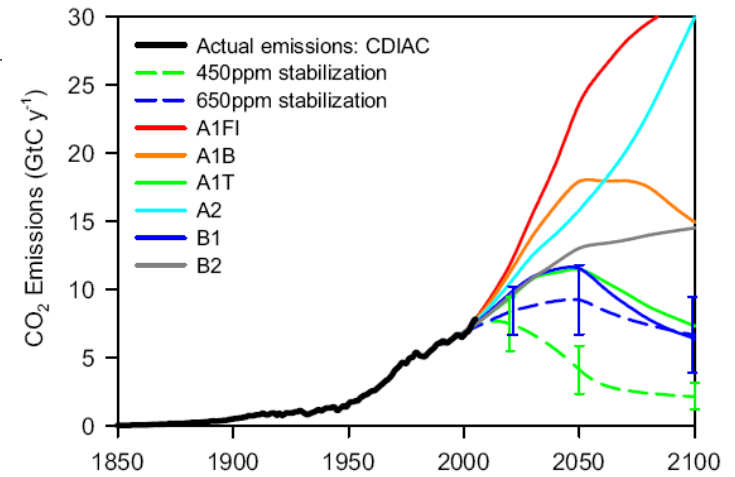
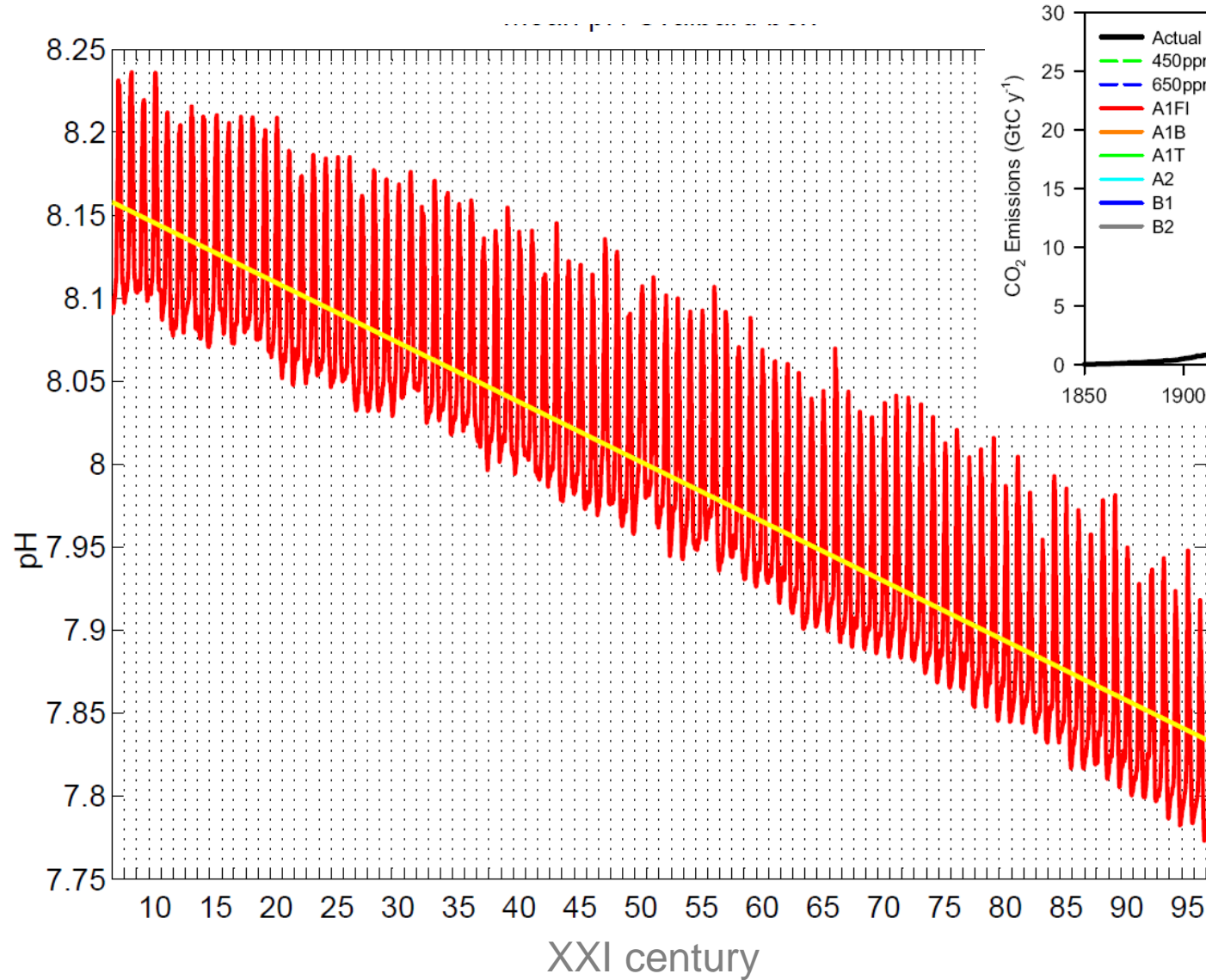
<sup>4</sup>Leibniz Institute of Marine Sciences (IFM-GEOMAR), Düsternbrooker Weg 20, 24105 Kiel, Germany





Slagstad, D. SINTEF, Trondheim, Norway

# Svalbard box: pH at A2 scenario



Source: Raupach et al., *PNAS*, 2007  
(Global Carbon Project)

pH drop - 0.3

# What we measured

## ■ Total alkalinity

- AT was measured using Gran potentiometric titration on a VINDTA system with a precision of  $3 \mu\text{mol.kg}^{-1}$ .

## ■ Total inorganic carbon dioxide

- CT was determined using coulometric titration with a precision of  $2 \mu\text{mol.kg}^{-1}$ .

# Initial

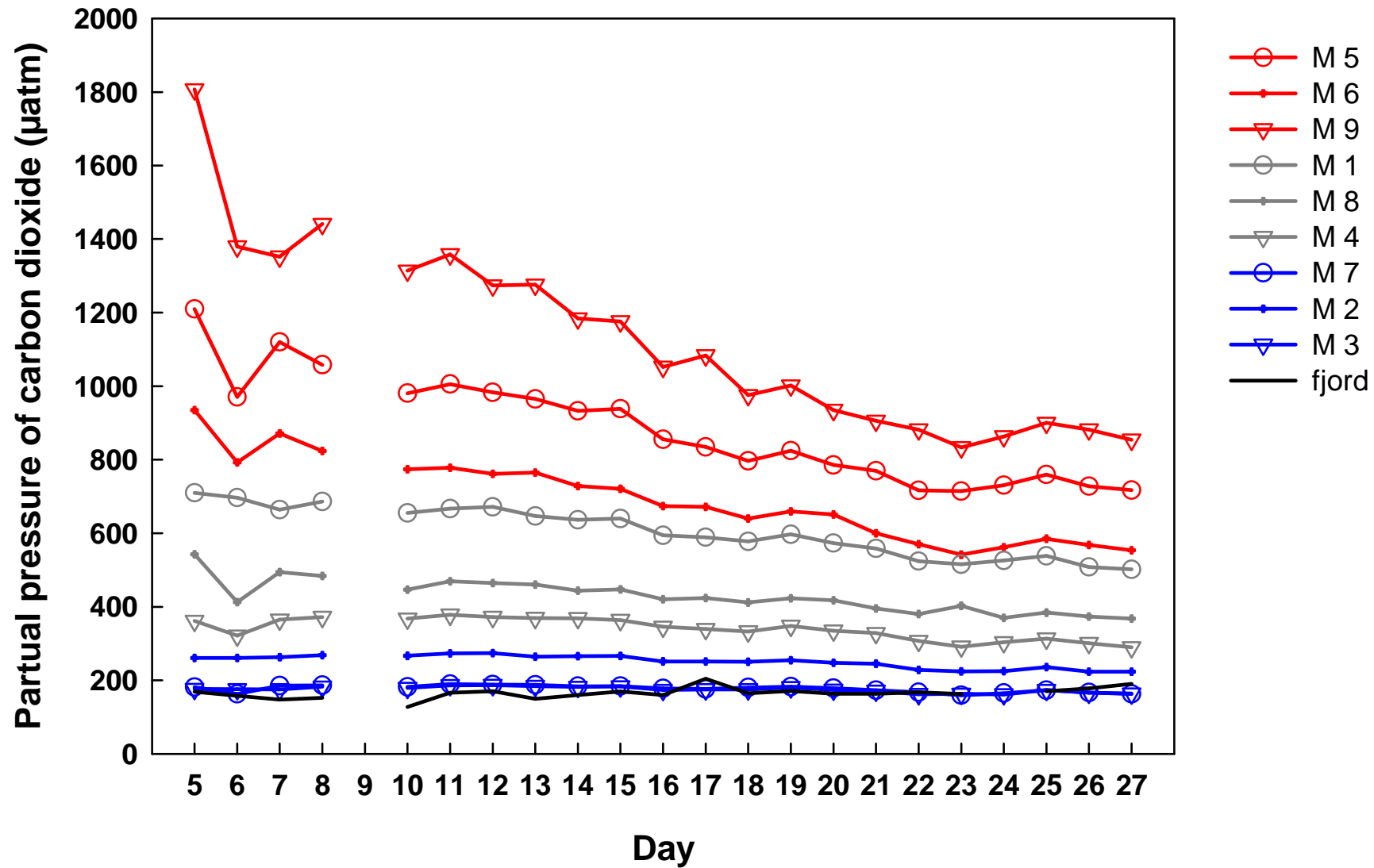
DIC <i>measured</i>	1978.05
Alkalinity <i>measured</i>	2234.08
pCO <sub>2</sub> <i>calculated</i>	170.50
pH <i>calculated</i>	8.35



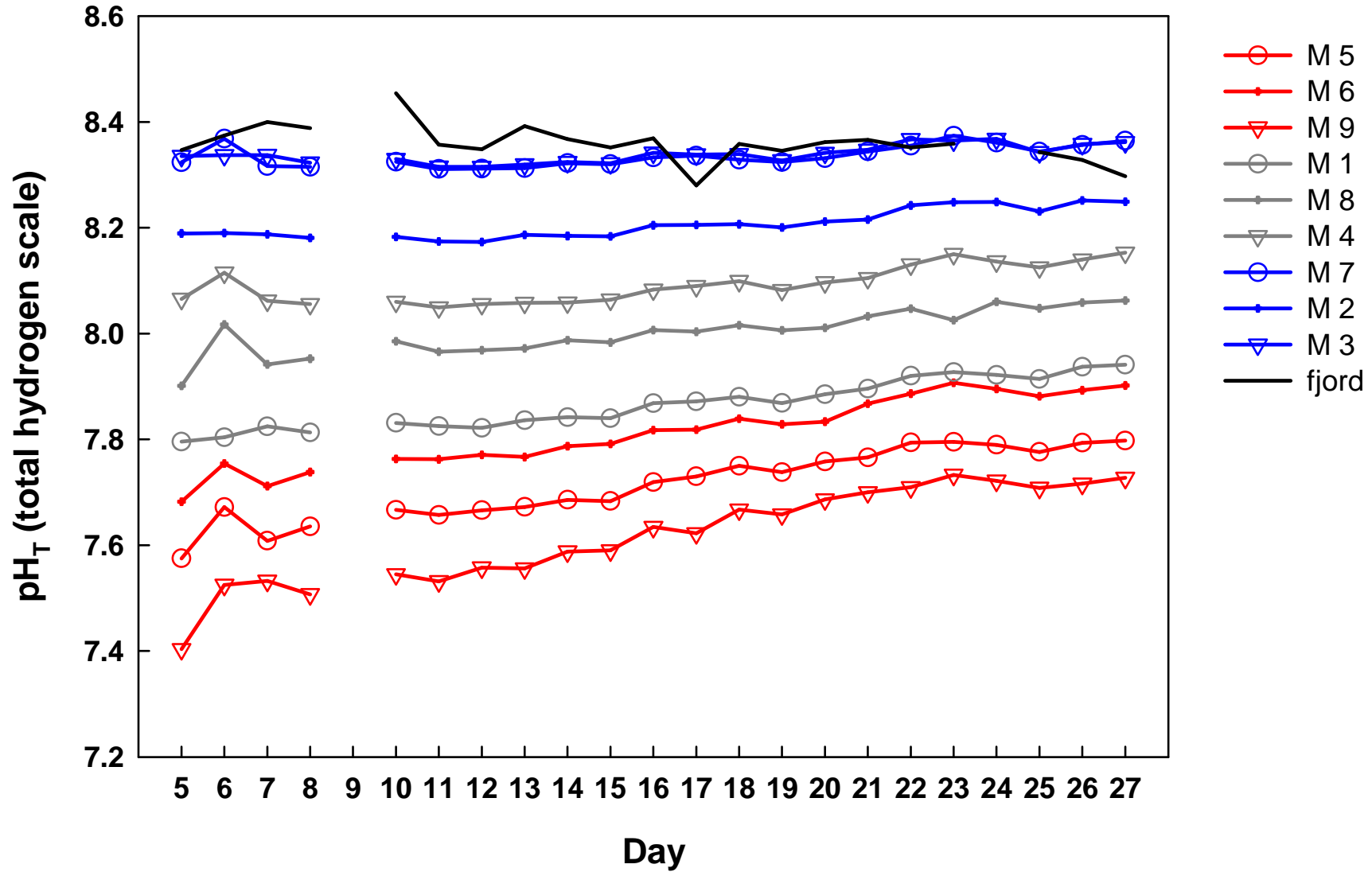
# Perturbation CO<sub>2</sub> levels (d5)

	pCO <sub>2</sub>	pH
<b>M3</b>	<b>176</b>	<b>8.34</b>
<b>M7</b>	<b>182</b>	<b>8.32</b>
<b>M2</b>	<b>260</b>	<b>8.19</b>
M4	361	8.07
M8	542	7.90
M1	710	7.80
<b>M6</b>	<b>935</b>	<b>7.68</b>
<b>M5</b>	<b>1210</b>	<b>7.58</b>
<b>M9</b>	<b>1807</b>	<b>7.40</b>

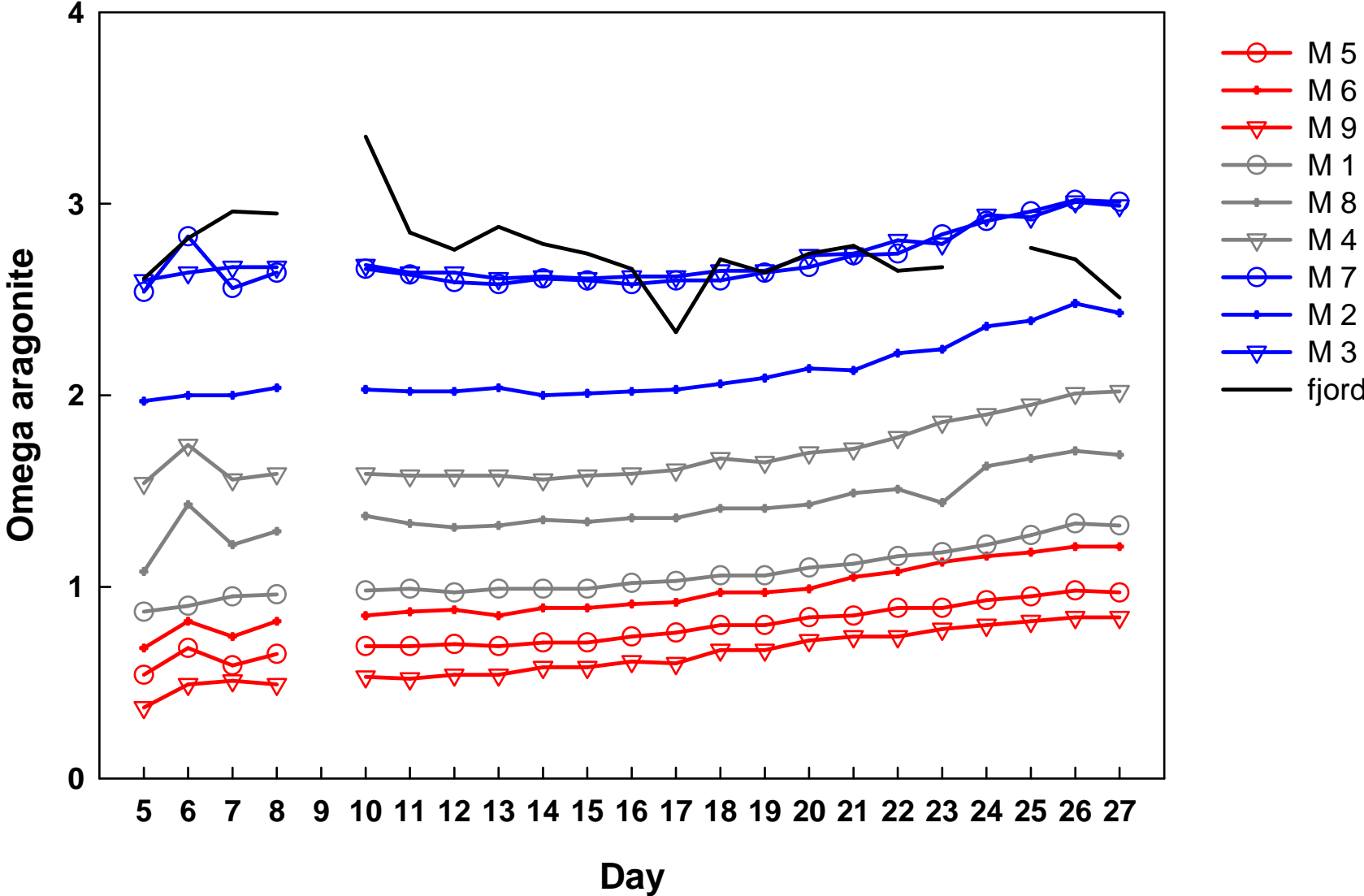
# Partial pressure of carbon dioxide



# pH

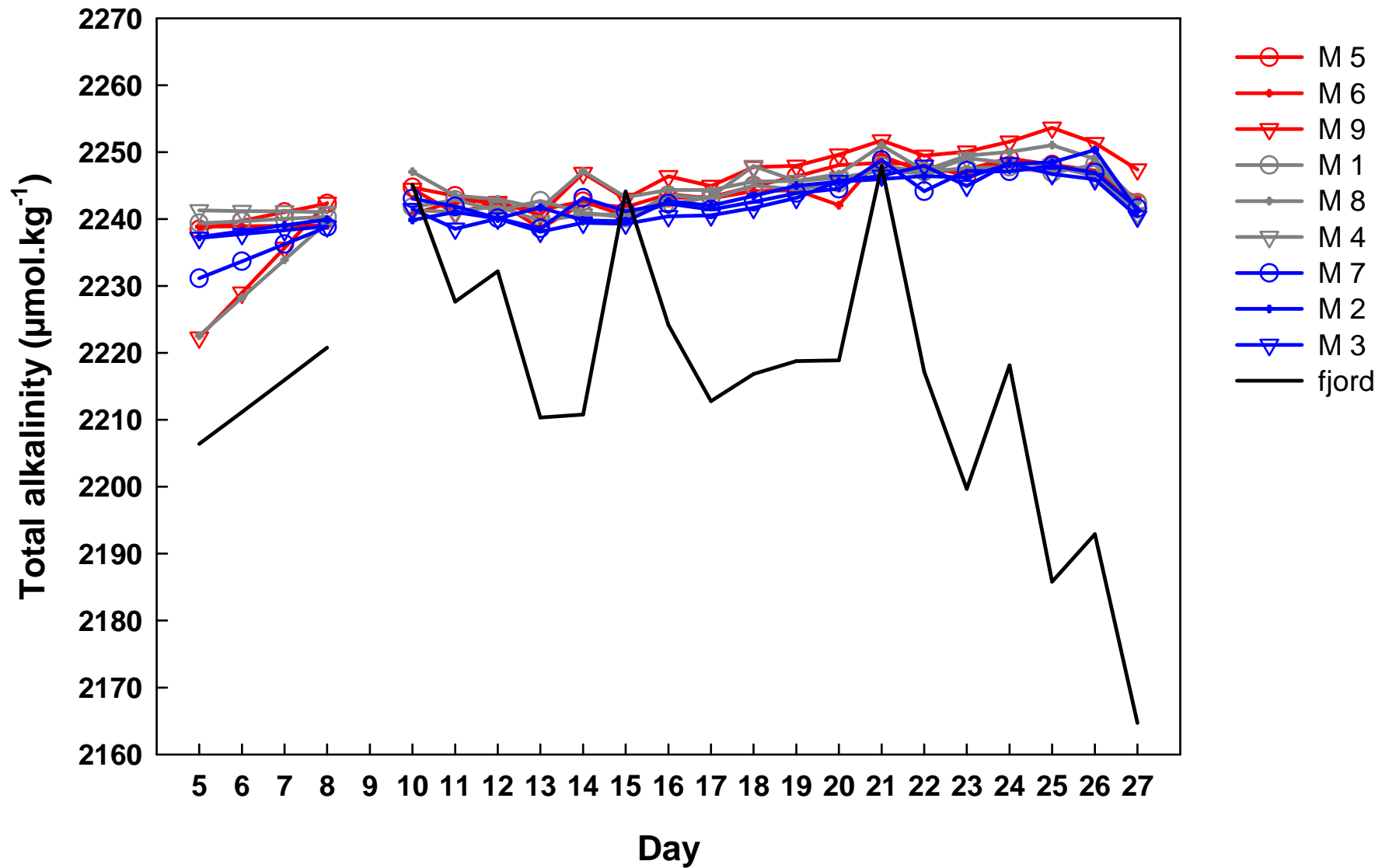


# Omega aragonite





# Total alkalinity

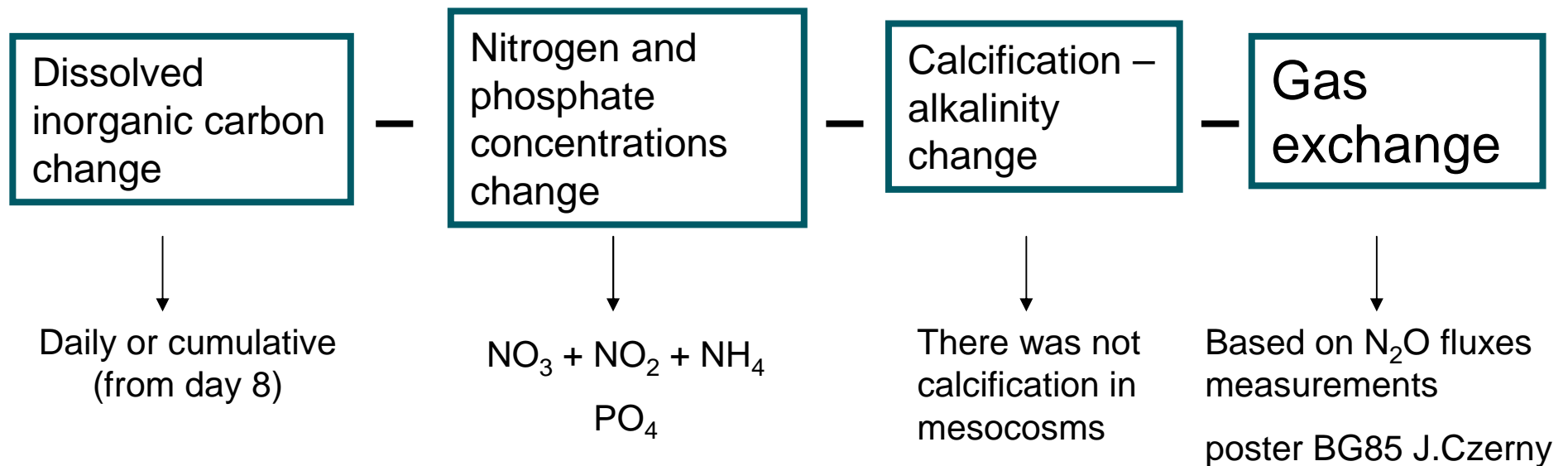


*no calcification in the system*

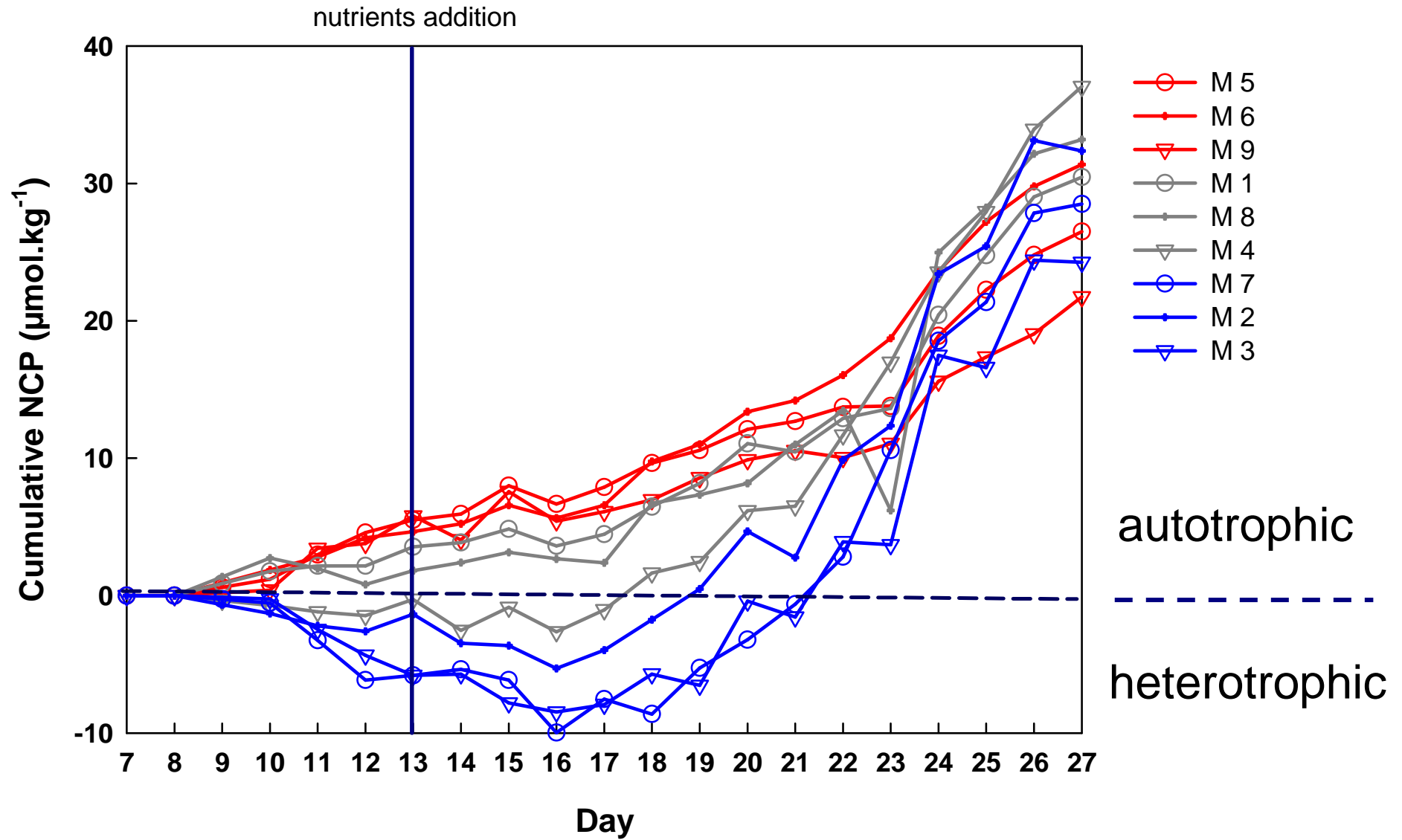
# Net community production (NCP)

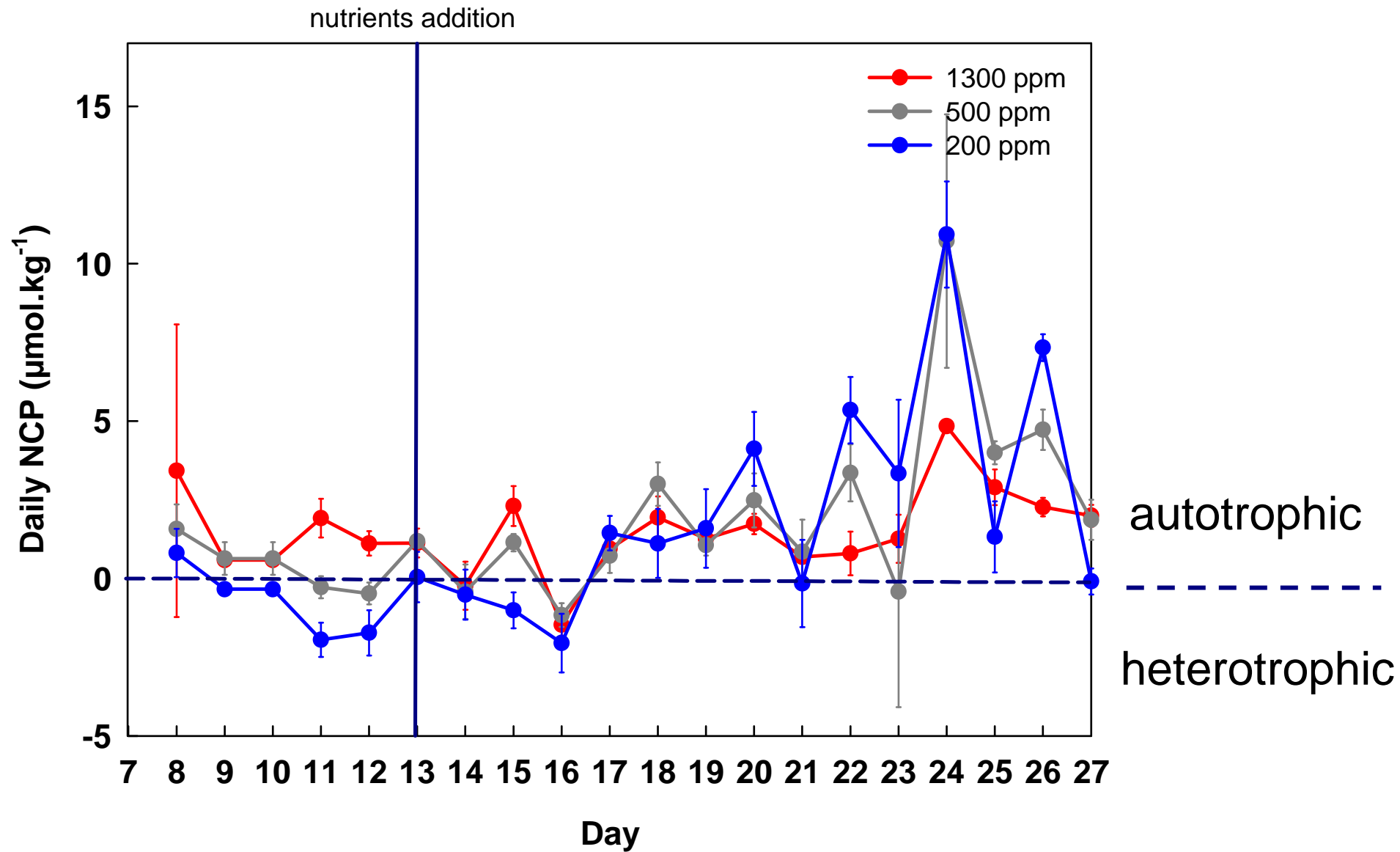
= Net inorganic carbon uptake ( $\mu\text{mol}/\text{kg}$ )

$$\text{NCP} = - \left( \frac{\Delta C_T}{\Delta t} \right) + 0.5 \cdot \left( \frac{(\Delta A_T - \Delta [\text{NO}_3] - \Delta [\text{PO}_4])}{\Delta t} \right) + \frac{\text{CO}_2(\text{ex})}{\Delta t}$$



# Cumulative NCP (inorganic carbon uptake)

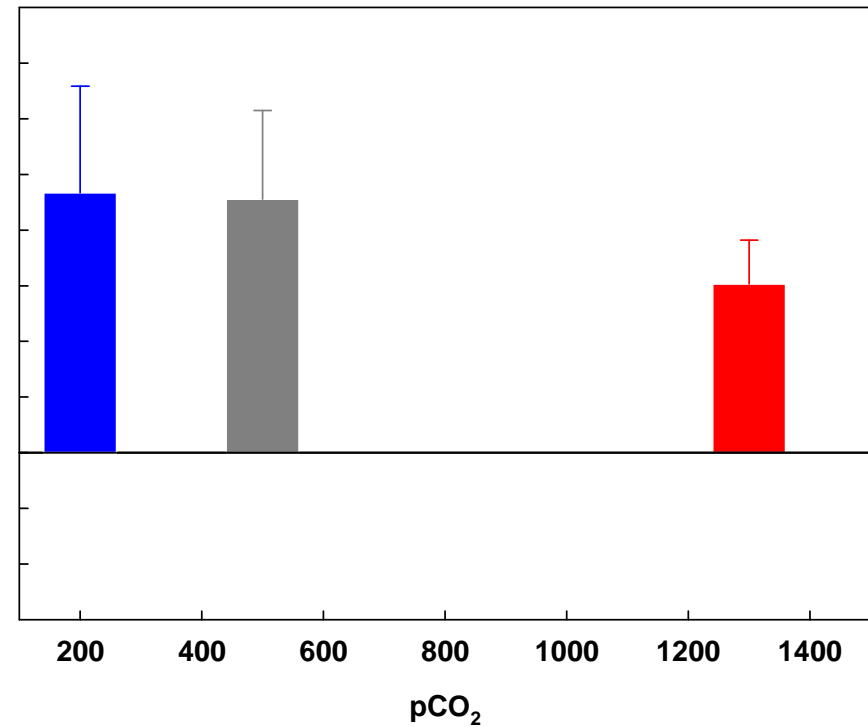
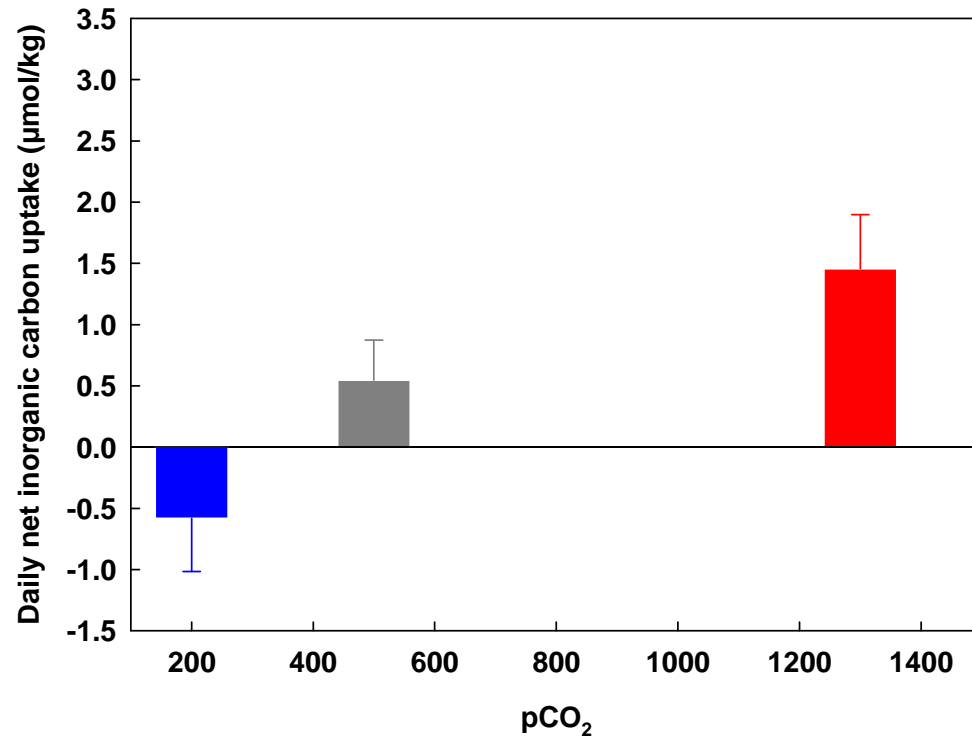


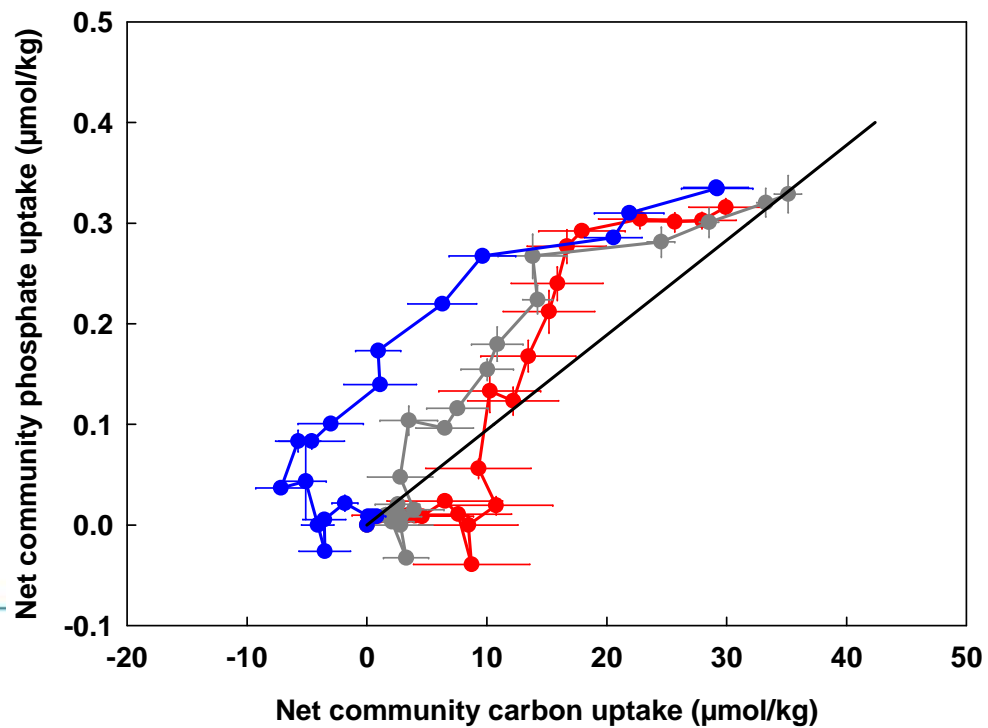
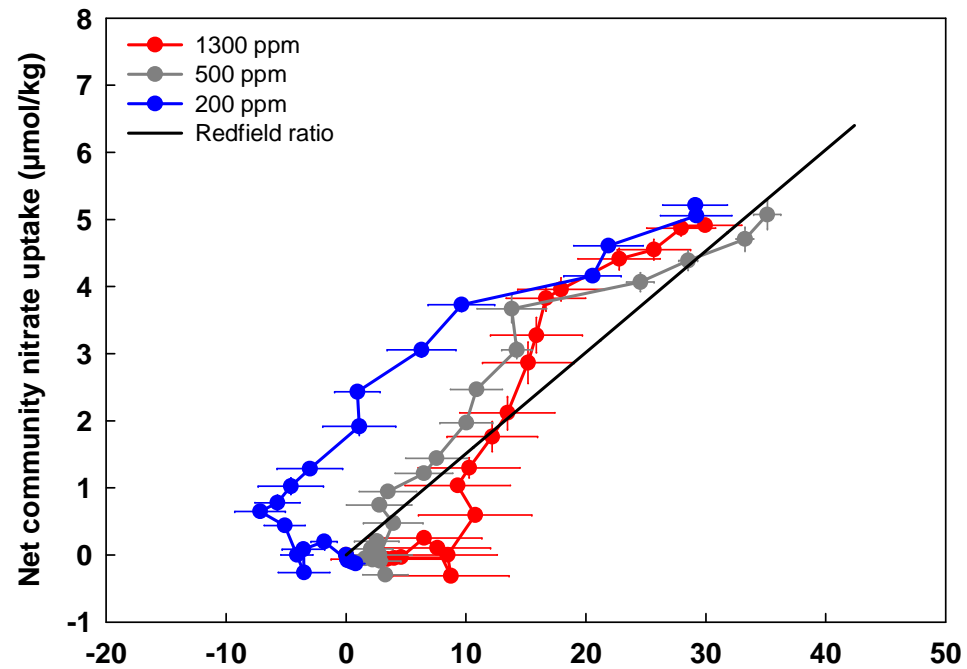


# Average daily inorganic carbon uptake

before nutrients addition

after nutrients addition





# Conclusions

- temporal evolution of Arctic waters carbon system was observed in a range of  $p\text{CO}_2$  levels from pre glacial to ~2100 year
- net community carbon uptake is affected by  $\text{CO}_2$  differently in nutrients absence and presence
- average daily NCP in low and medium  $\text{CO}_2$  levels after nutrients addition was 30% greater than in the highest  $p\text{CO}_2$
- for the same amount of nutrients consumed there is decreasing amount of carbon uptake towards high  $p\text{CO}_2$

---

*Thank you for attention*

