

# Emerging properties of phytoplankton community size structures in regions of contrasting environmental conditions of the Atlantic Ocean

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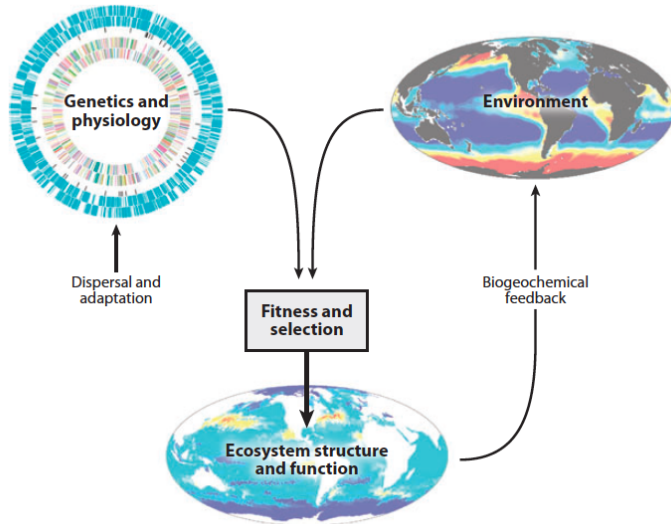
School of Engineering and Sciences  
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Systems Ecology Group  
Leibniz Center for Tropical Marine Ecology

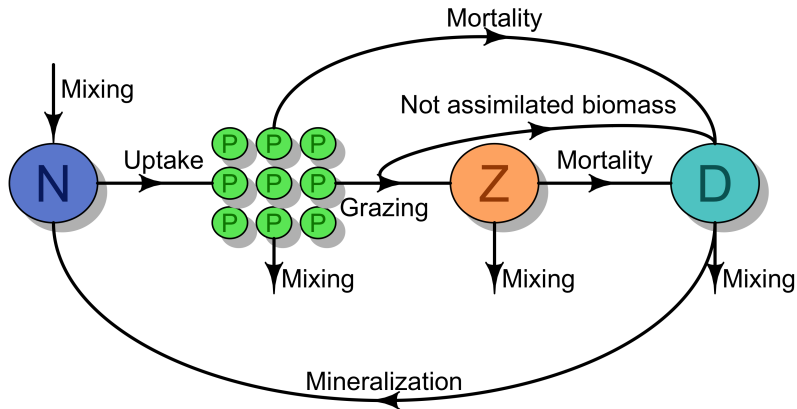
27.8.13



# Importance of the environmental conditions

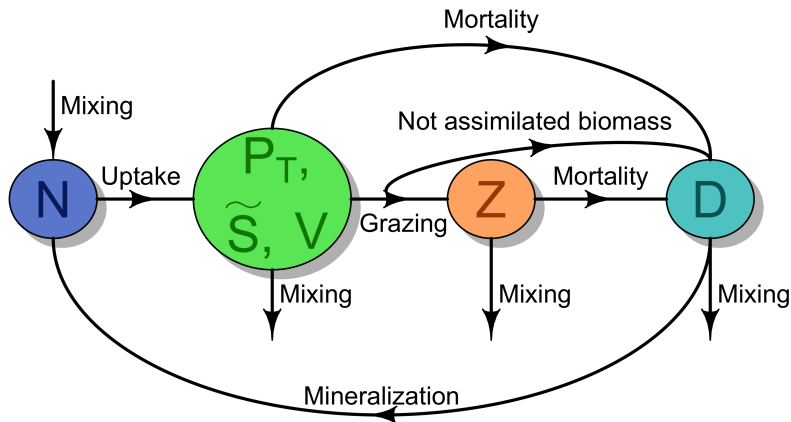


# A model of a phytoplankton community



Traditional approach

# A model of a phytoplankton community



## Complex Adaptive Systems approach

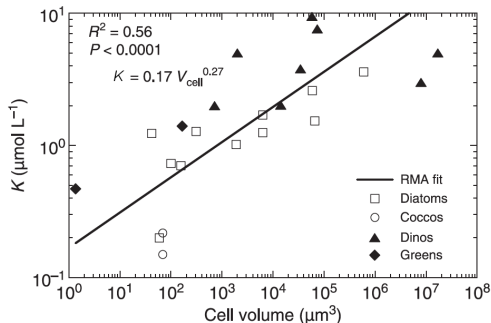
similar to: Wirtz & Eckhardt 1996; Norberg et al 2001; Bruggeman & Kooijman 2007; Merico et al 2009

## Nutrient Uptake ( $U_N$ )

Phytoplankton **nutrient uptake** as a function of **size**:

$$U_N(N, S) = \frac{N}{N + K_N}$$

$$U_N(N, S) = \frac{N}{N + (0.17 S^{0.27})}$$



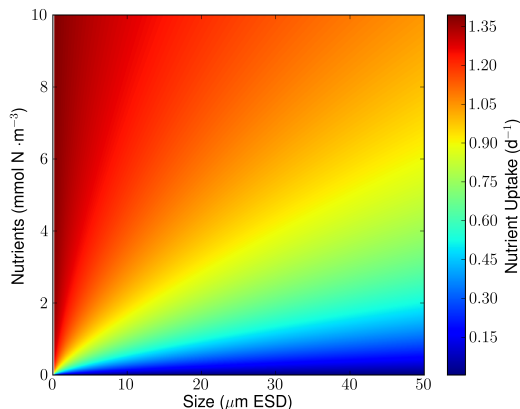
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Litchman et al. 2007



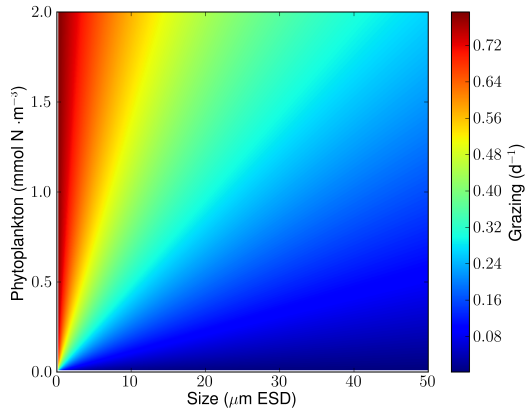
**favours smaller phytoplankton**

## Grazing ( $f_Z$ )

Zooplankton **grazing** as a function of phytoplankton **size**:

$$f_Z(P, S) = \frac{\frac{1}{S}}{\frac{P}{S} + K_P}$$

Merico et al. 2009



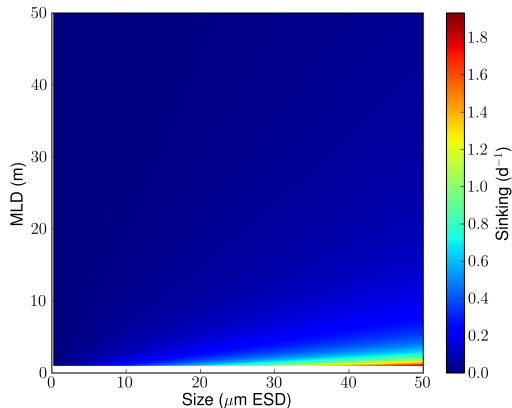
favours larger phytoplankton

## Sinking ( $\nu$ )

Phytoplankton **sinking** as  
a function of **size**:

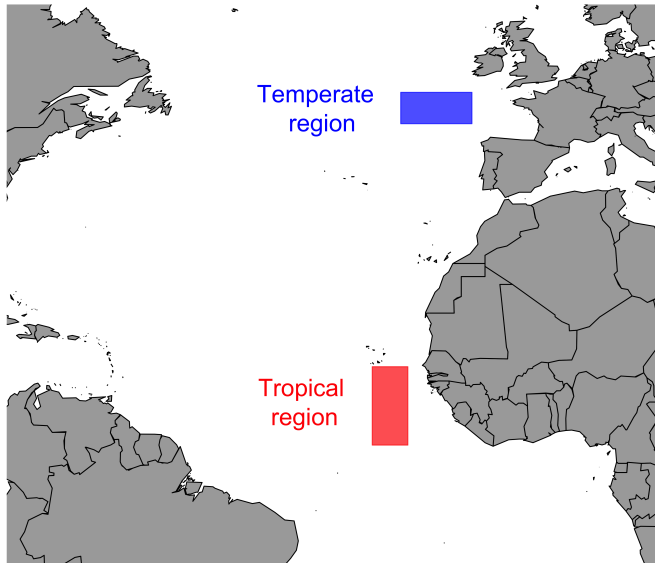
$$\nu(S, \text{MLD}) = \frac{0.02 S^{1.17}}{\text{MLD}}$$

Stokes' law (Smayda 1970, Kiørboe 1993)

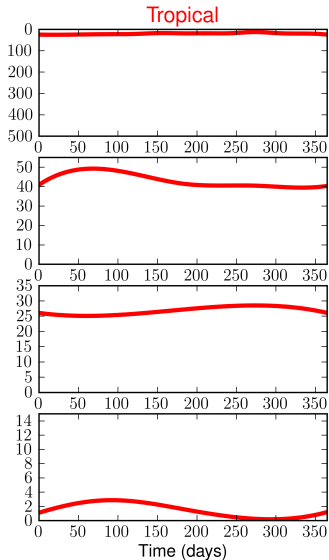
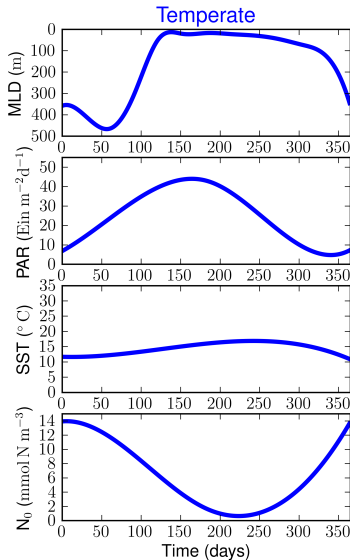


favours smaller phytoplankton

# Model setups

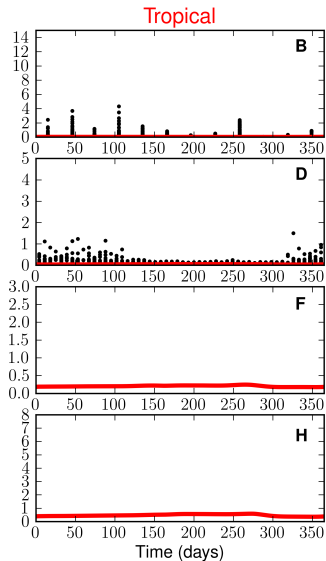
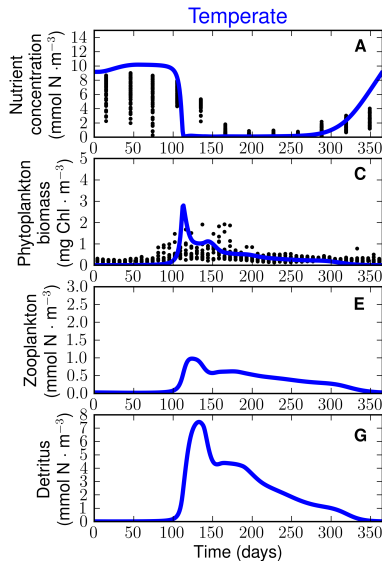


# Model setups



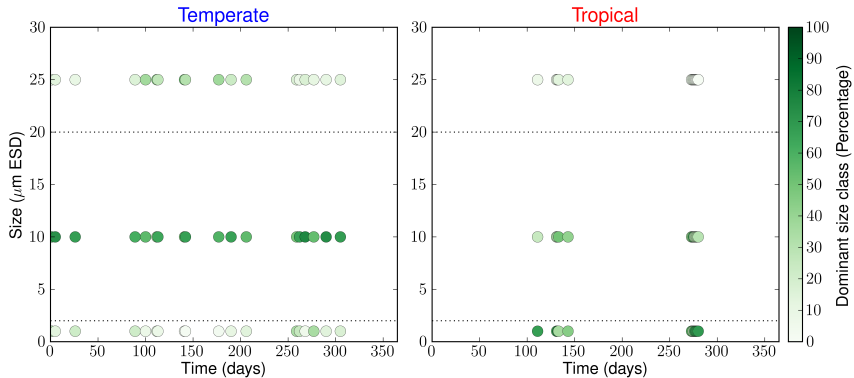
...these are the only differences between the two model setups

# Results



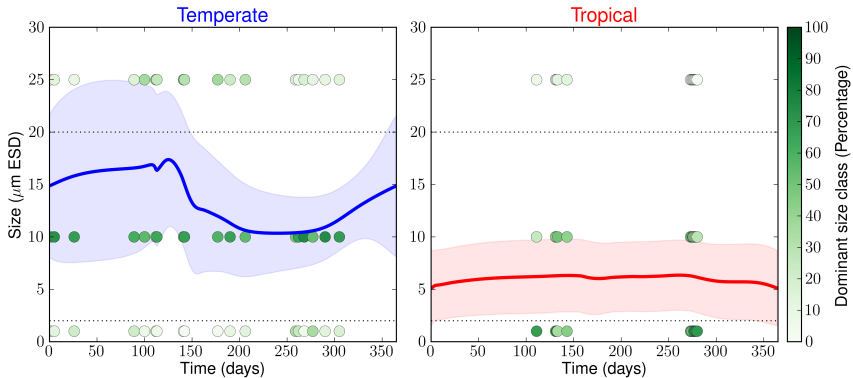
Data source: Nitrate (WOA 2009) and chlorophyll (MODIS, Ocean Color - NASA)

# Results



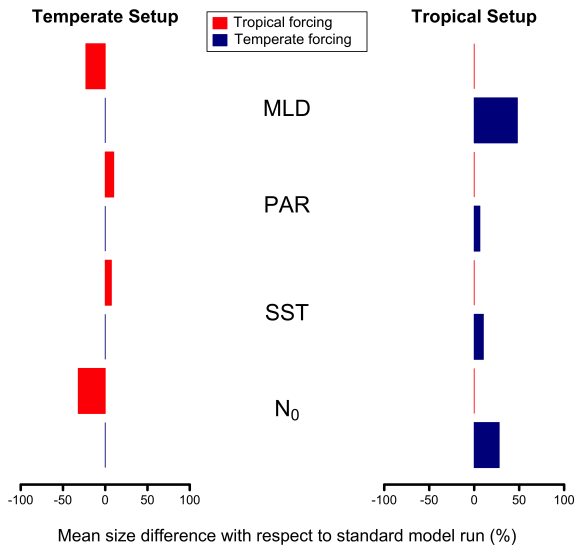
High Performance Liquid Chromatography (HPLC) data from Dandonneau et al. (2004), Werdell & Bailey (2005)  
and AMT programme

# Results

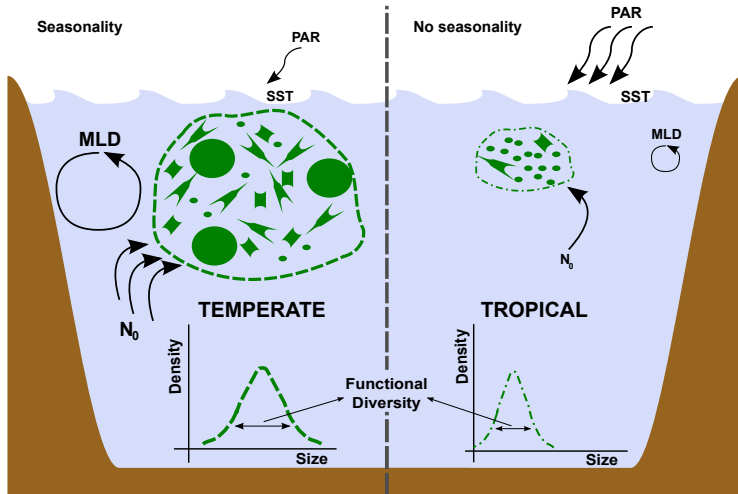


High Performance Liquid Chromatography (HPLC) data from Dandonneau et al. (2004), Werdell & Bailey (2005)  
and AMT programme

# Sensitivity to environmental conditions



# Summary



**Thank you for your attention...**