Biological N_2 fixation in the Galician upwelling system: magnitude, relevance and main players

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Grupo de Oceanografía Biolóxica

CdM ISC '16

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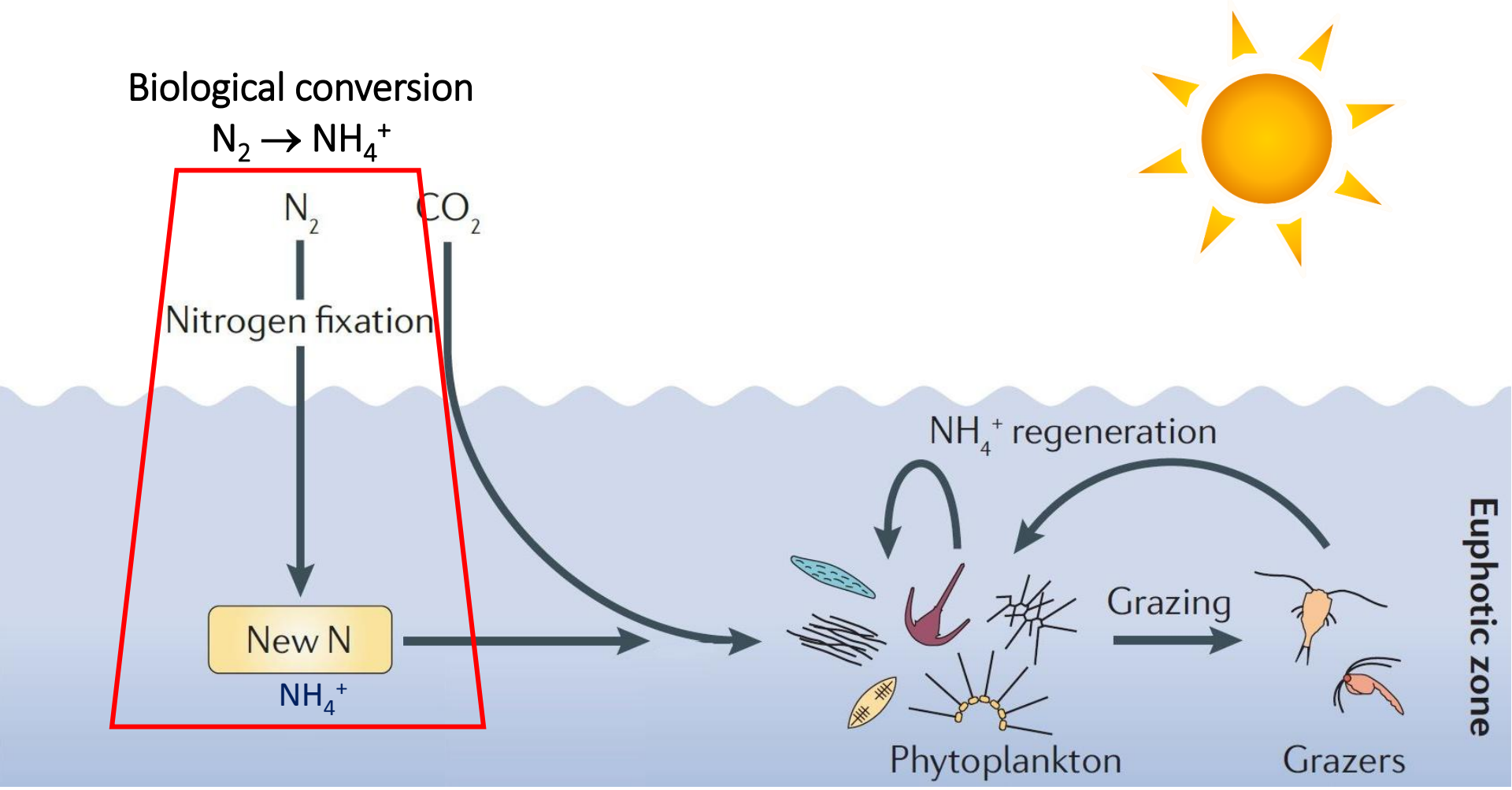
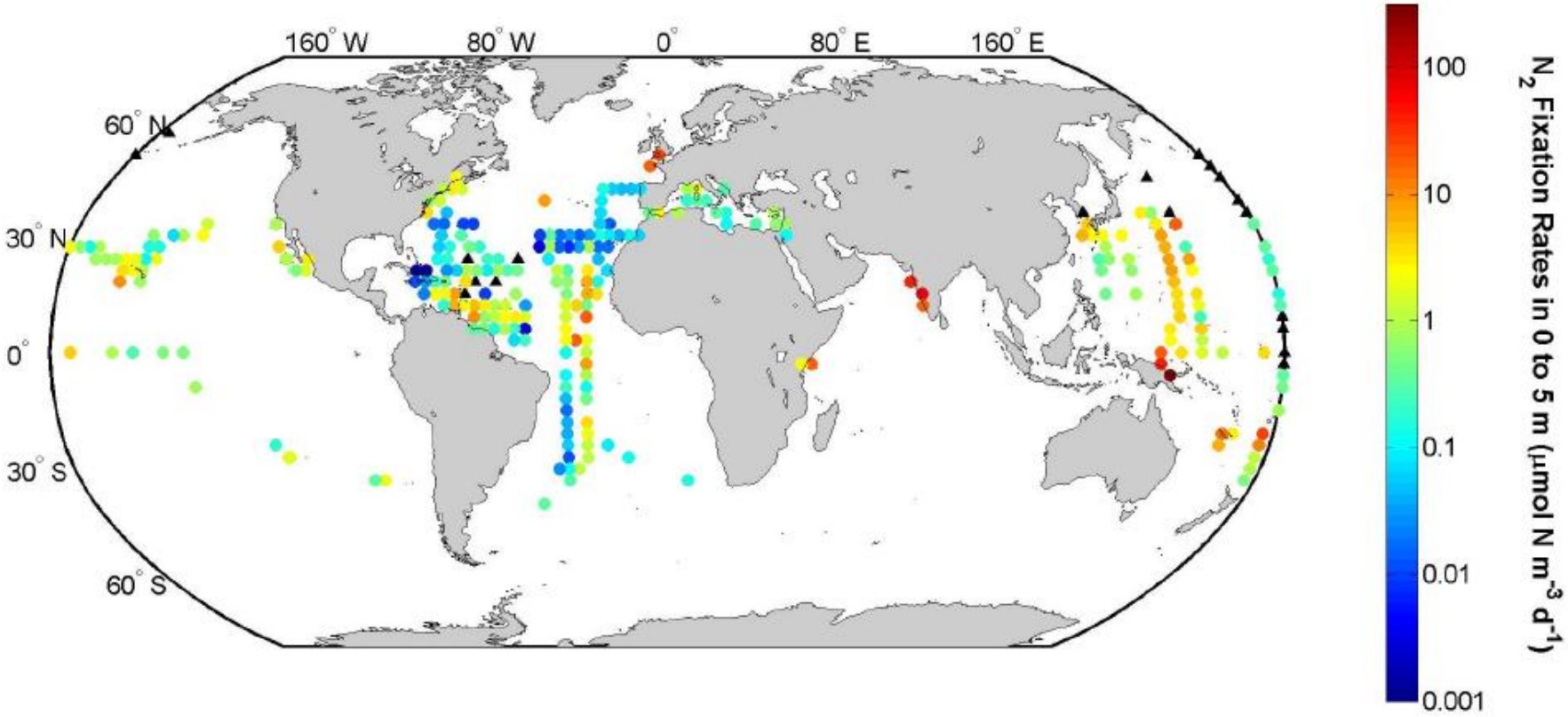
What is Biological Nitrogen Fixation?



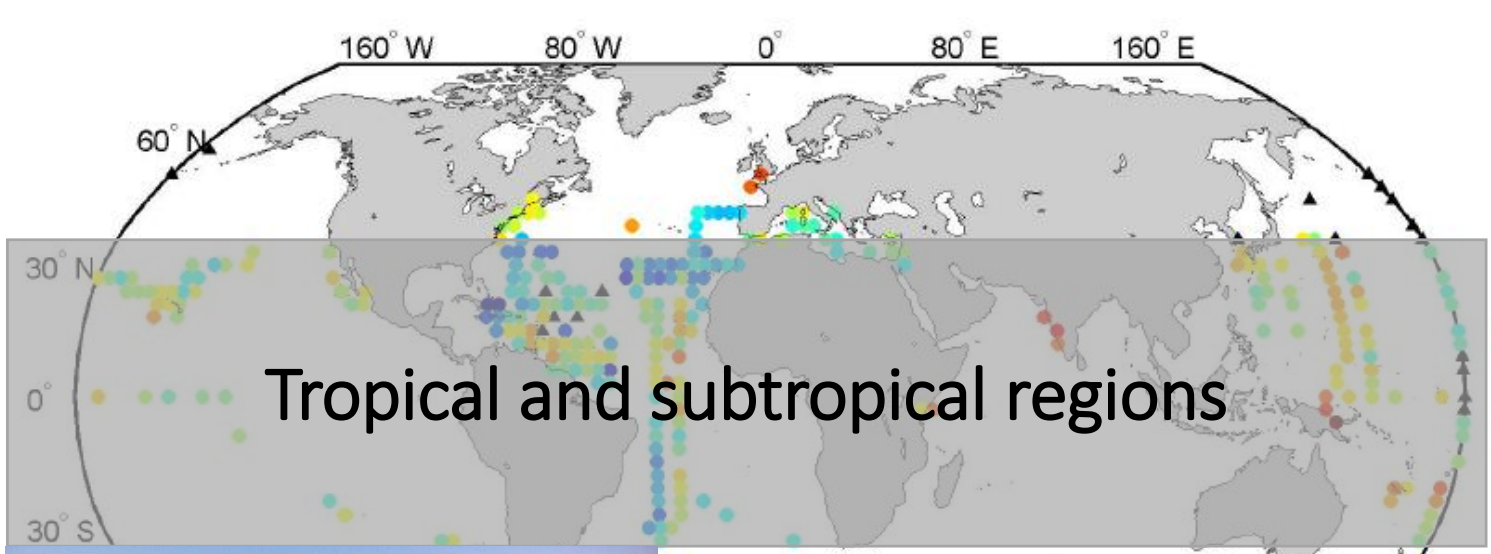
Modified from Sohm et al., 2011

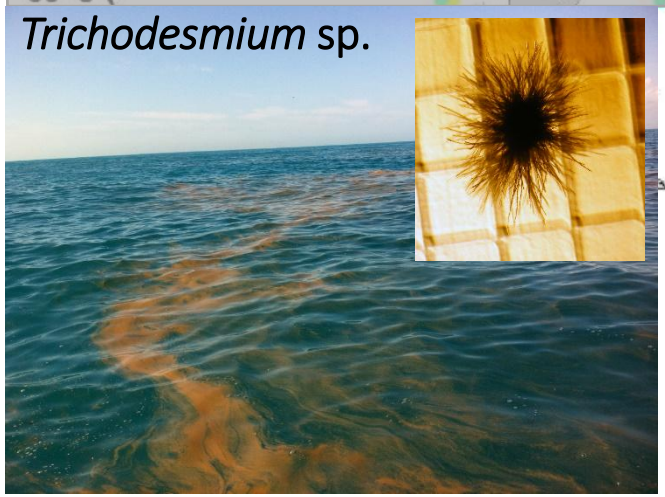
Background

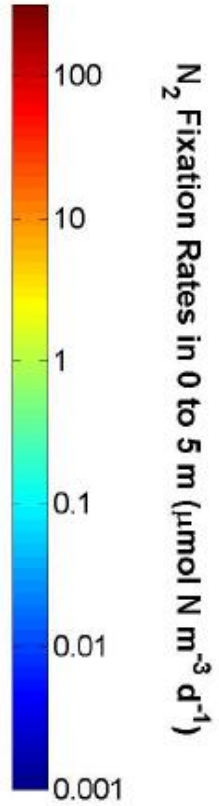


Luo et al., 2012

Background



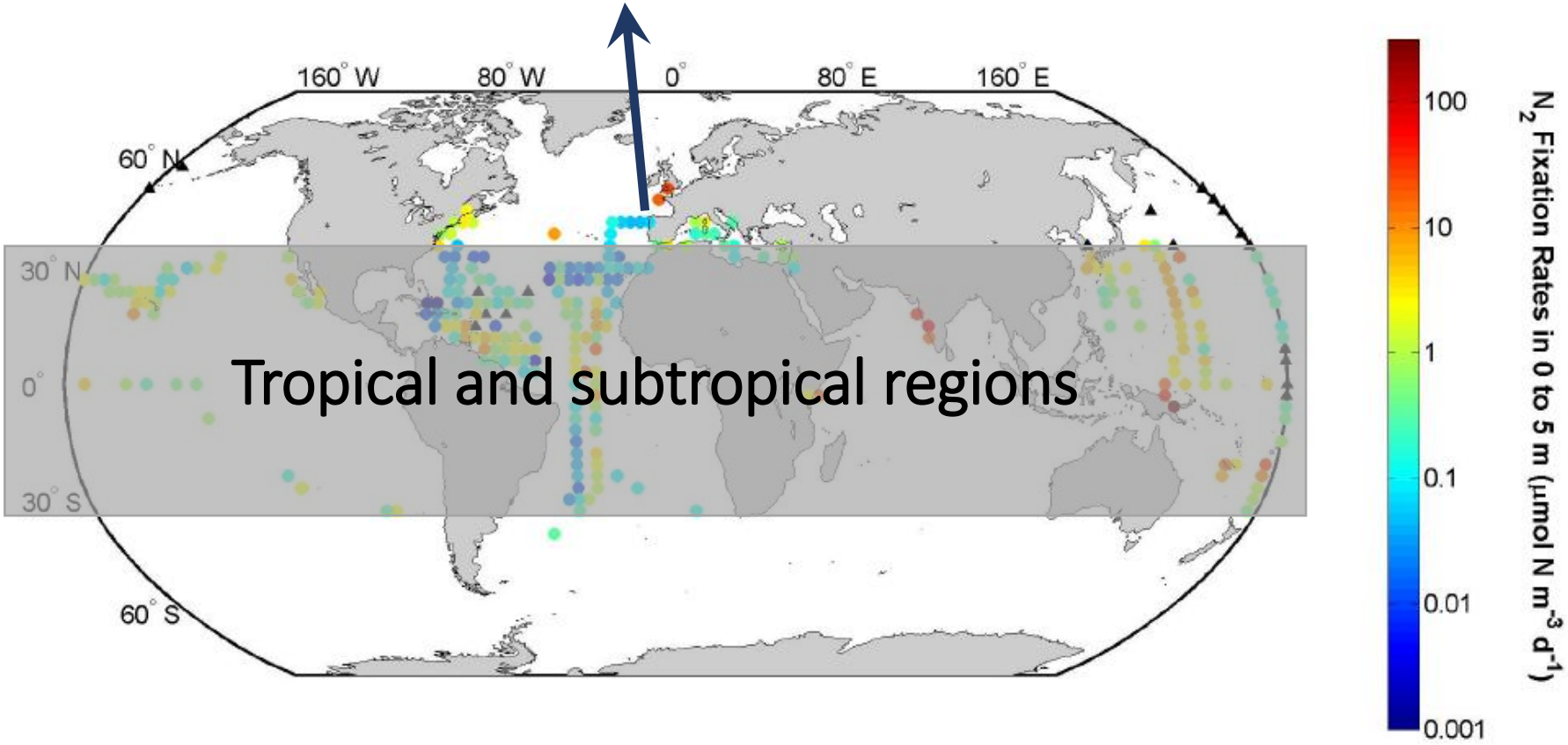




From TRYNITROP Project and www.whoi.edu

Background:
evidences of N_2 fixation in N-rich temperate regions

Upwelling region off NW Iberia, July 2009 (Benavides et al., 2011; Agawin et al., 2014)

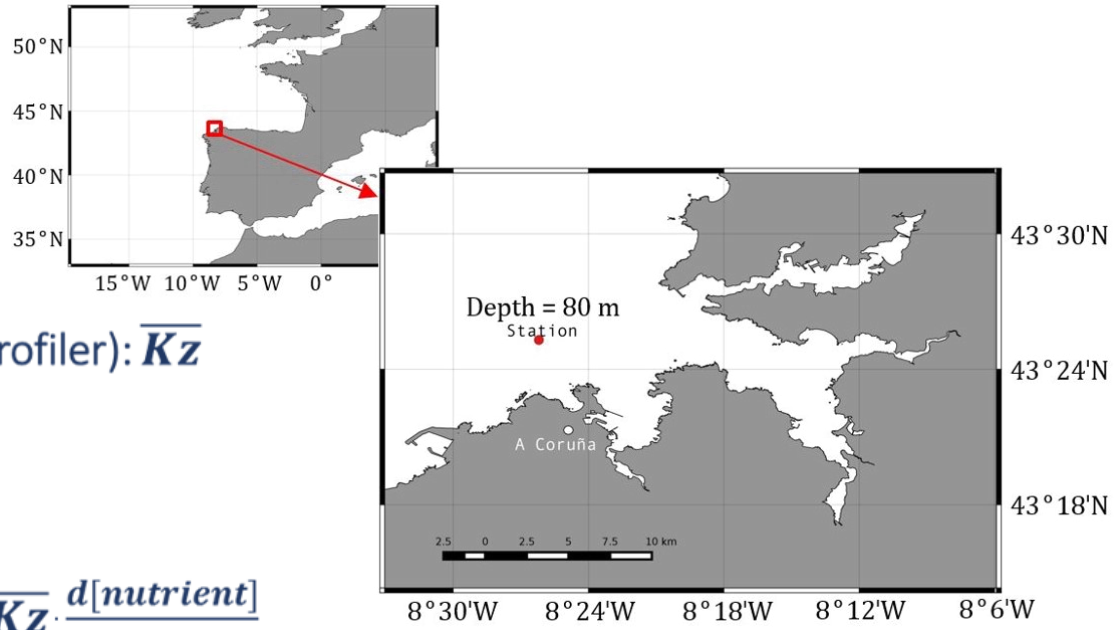


Our goals

1) To describe the seasonal variability of N_2 fixation and quantify its biogeochemical relevance.

2) To characterize the diazotrophic community.

Study area & Methods

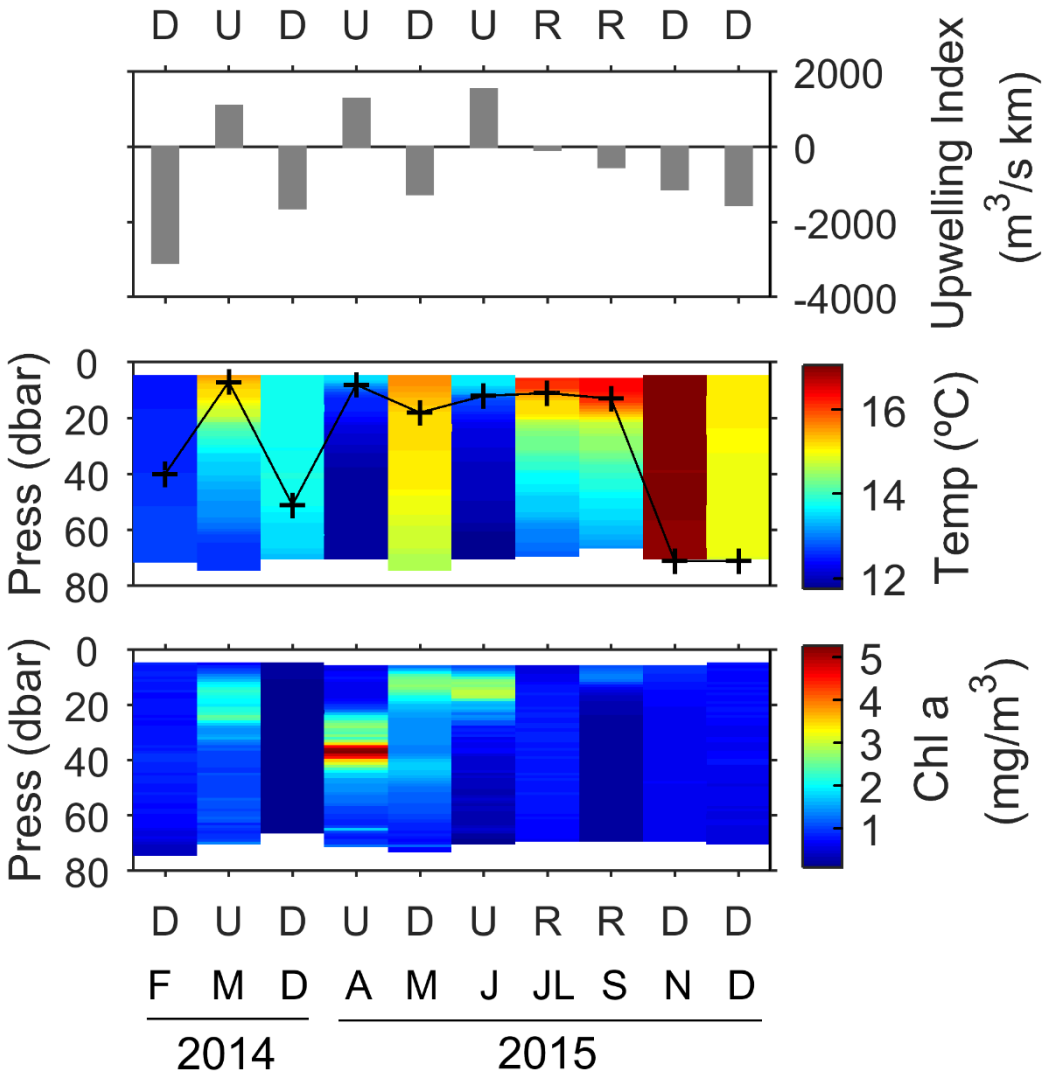


10 samplings (Feb 2014 - Dec 2015):

- Microstructure turbulence (MSS profiler): $\overline{Kz}$
- Inorganic nutrients: $\frac{d[nutrient]}{dz}$
- Diffusive fluxes: $Flux_{nutrient} = \overline{Kz} \cdot \frac{d[nutrient]}{dz}$
- Primary Production (^{14}C-uptake)
- Chlorophyll *a*
- Size-fractionated N_2 fixation rates ($^{15}N_2$-uptake)
- Diversity of diazotrophic community (NGS Technology-Illumina®)
- Abundance of main diazotrophs (qPCR)

MSS profiler

Hydrography



Hydrographic conditions

U: Upwelling (↑ Chl *a*, Bloom)

D: Downwelling (↑ Mixing)

R: Relaxation (↑ Stratification)

Mixed layer depth

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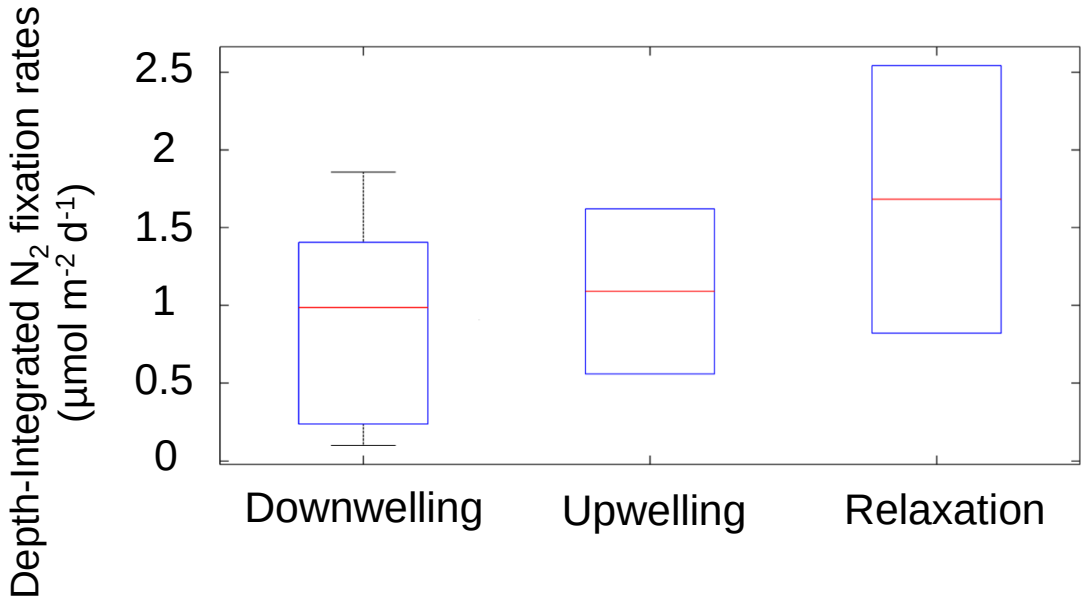
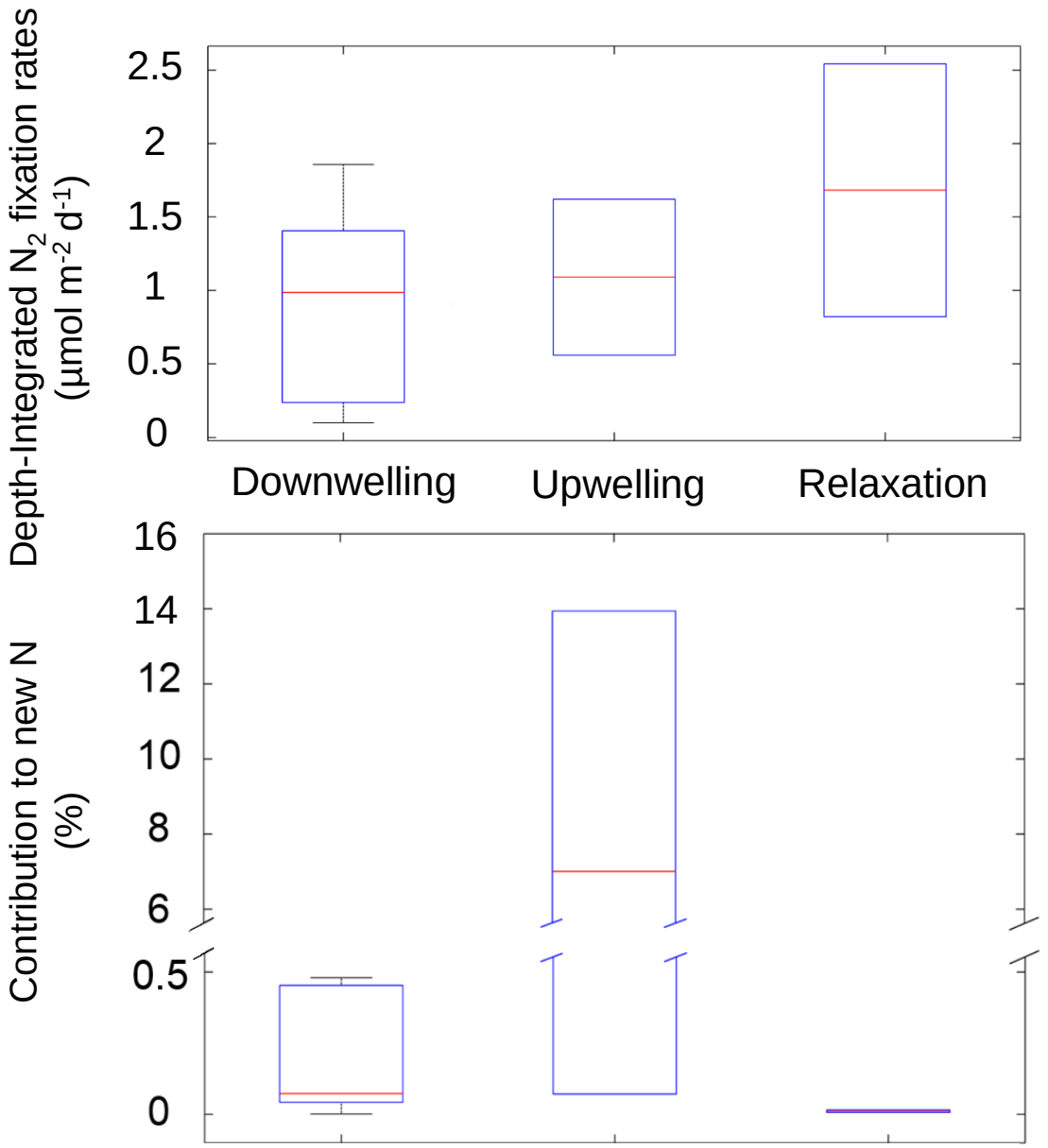
Seasonal variability of N_2 fixation



N_2 fixation similar to the lower-end of rates described for NASE

Seasonal variability of N_2 fixation and biogeochemical role



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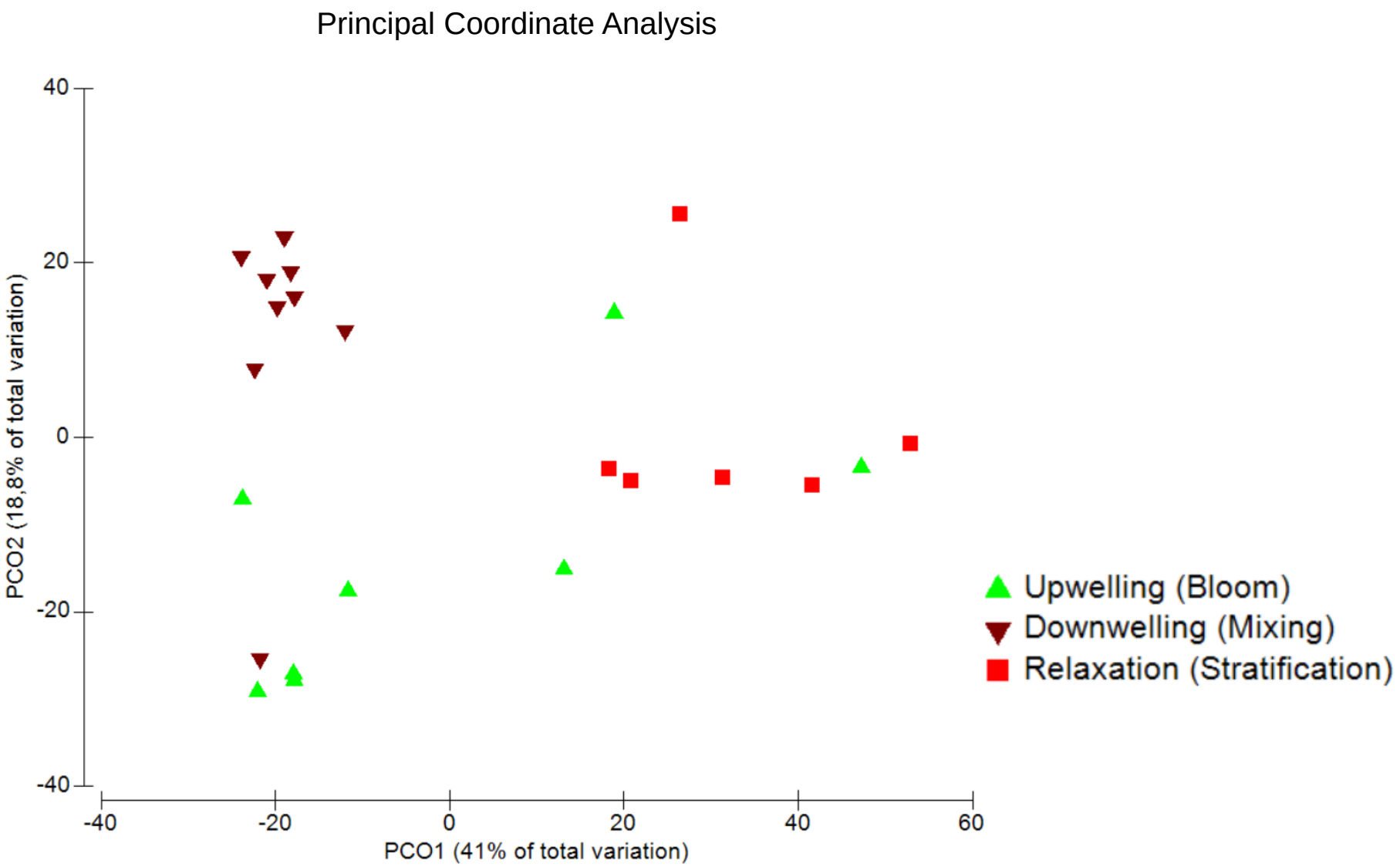
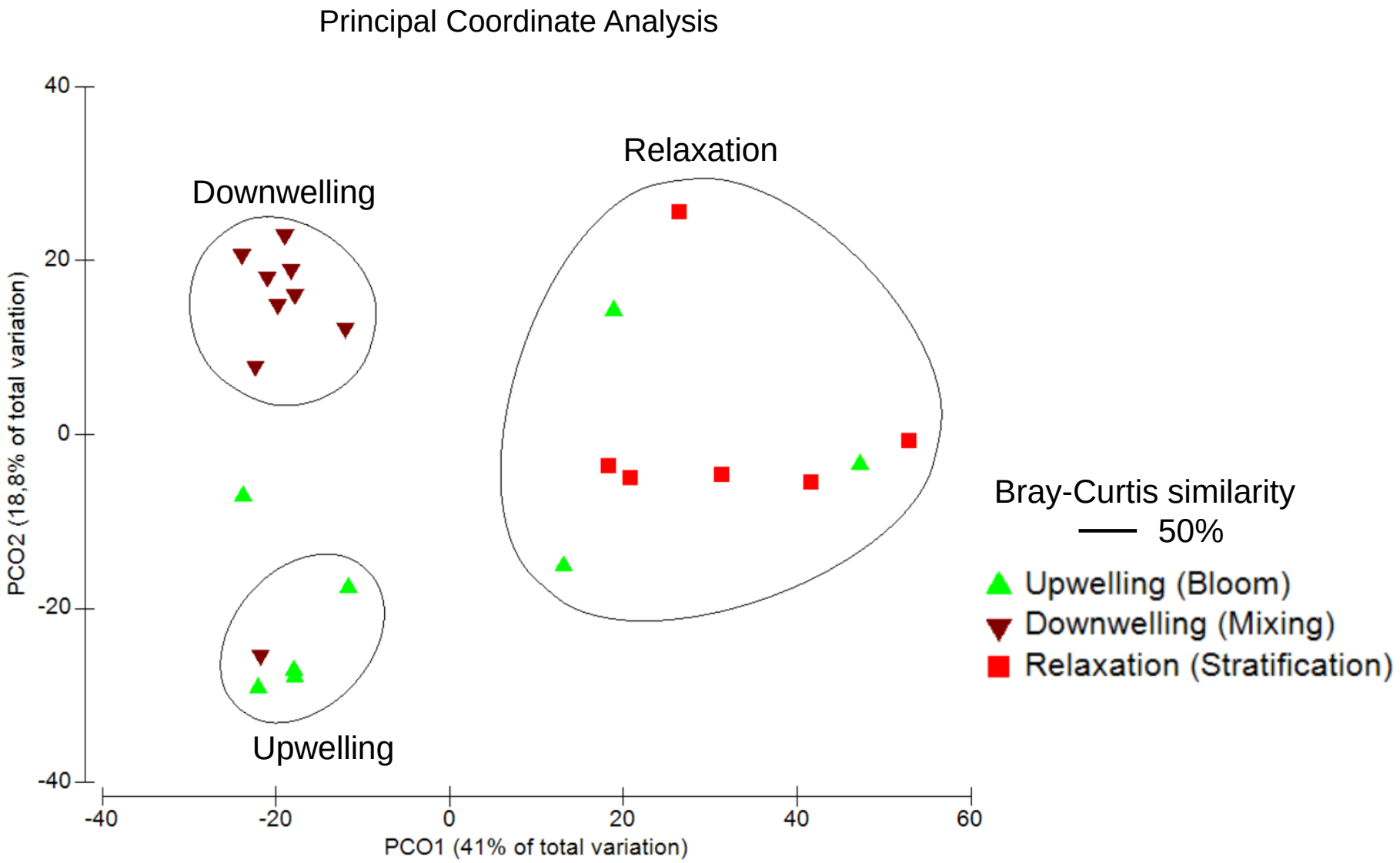
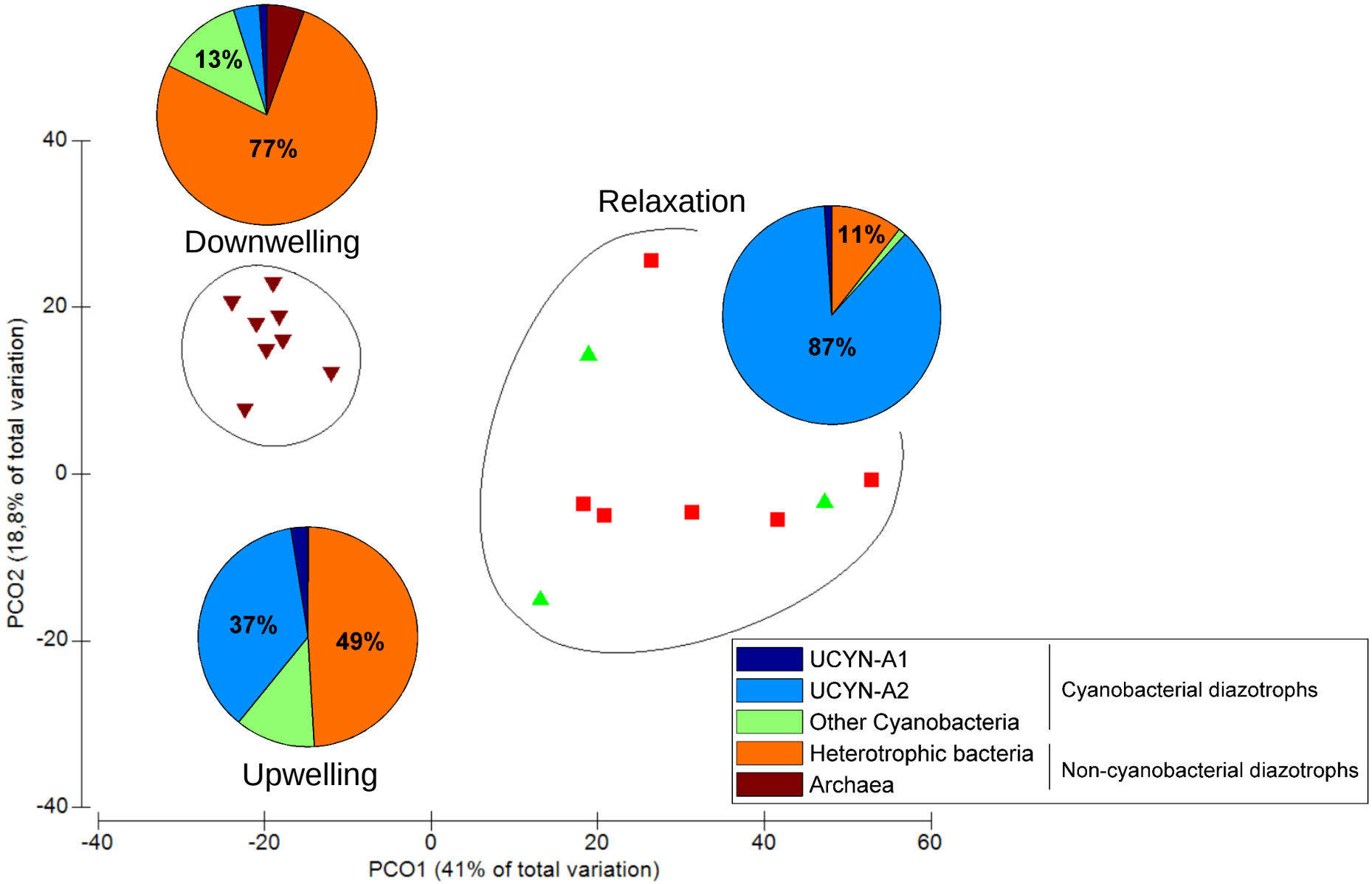
Diazotrophic community composition



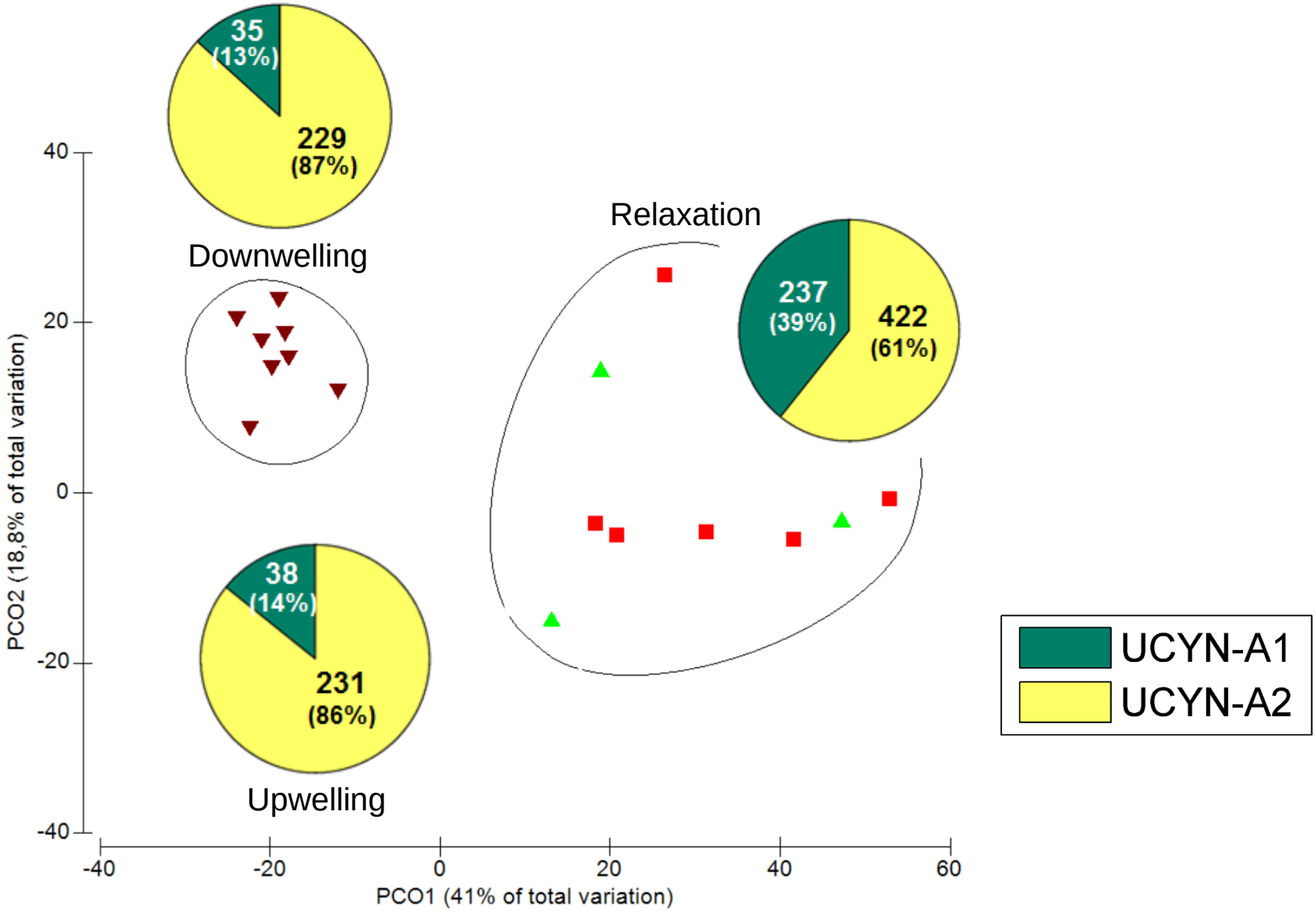
Diazotrophic community composition: clusters



Diazotrophic community composition



UCYN-A1 and UCYN-A2 abundance (*nifH* copies L^{-1})



Conclusions

1) N_2 fixation slightly higher during relaxation (0.1–2.5 µmol N m^{-2} d^{-1}).

2) Minor biogeochemical role (< 14%).

3) Seasonal variability in diazotrophic community:
   - UCYN-A2: Relaxation-Stratification.
   - Heterotrophic bacteria: Downwelling-Mixing.
   - Similar contribution of both groups: Upwelling-Bloom.

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Thank you for your attention!

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