

Eurofleets⁺

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Diazotroph connectomics across Gulf Stream eddies impact N₂ fixation in the North Atlantic

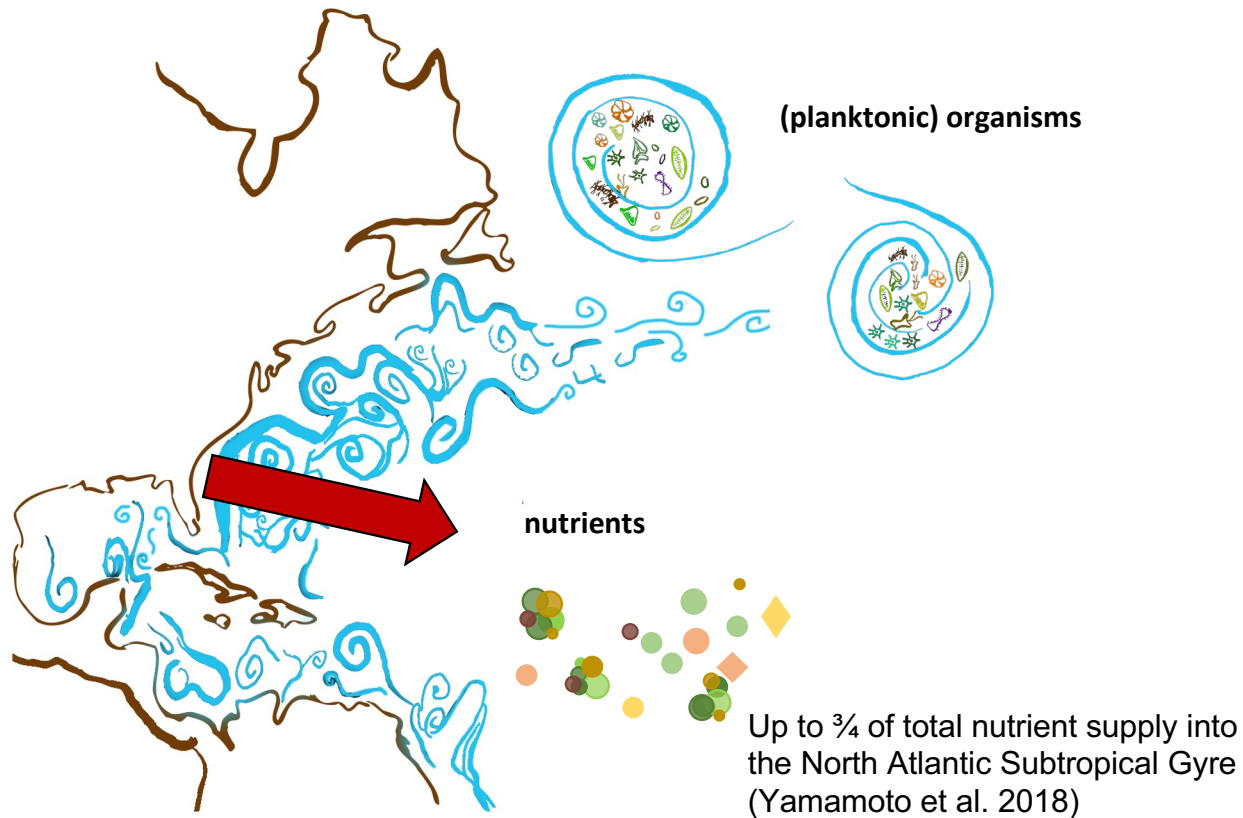
Cora Hoerstmann, Stéphanie Barrillon, Olivier Grosso, Cécile Carpaneto Bastos, Caroline Le Bihan, Borja Aguiar-González, M. Dolores Pérez-Hernández, Lidia Carracedo, Mar Benavides



Connectomics?



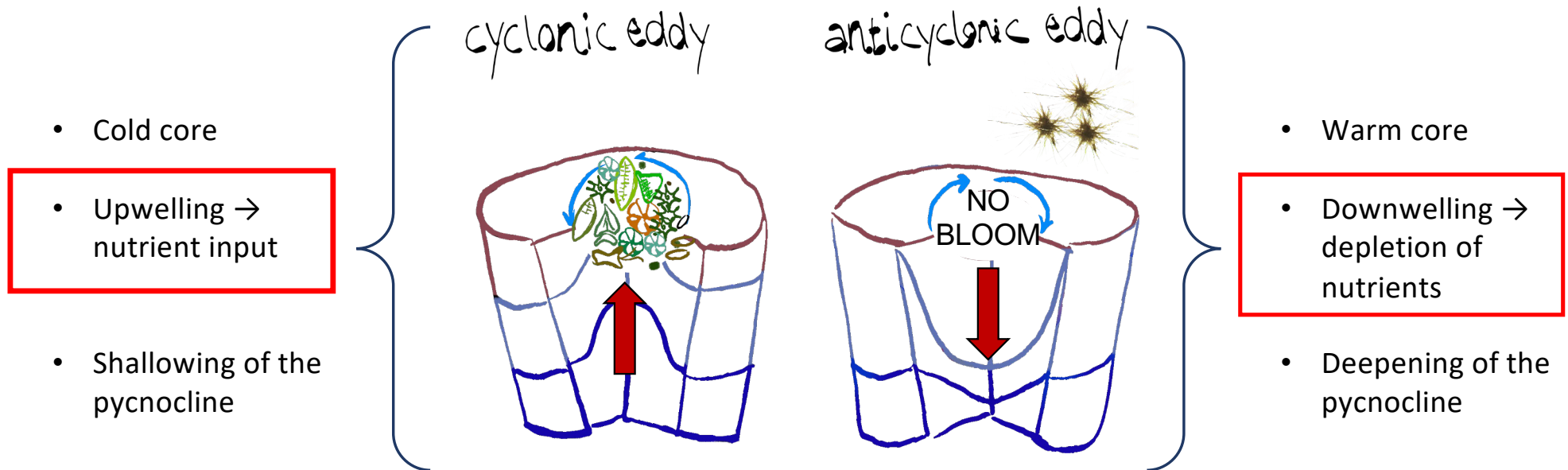
Ecosystem structure shaped by ocean eddies



Passive influences:
transport, mixing, dilution

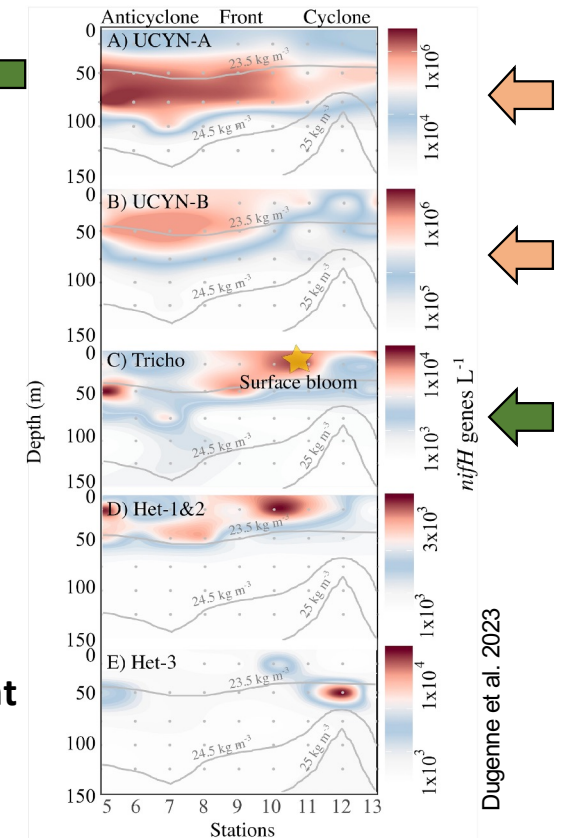
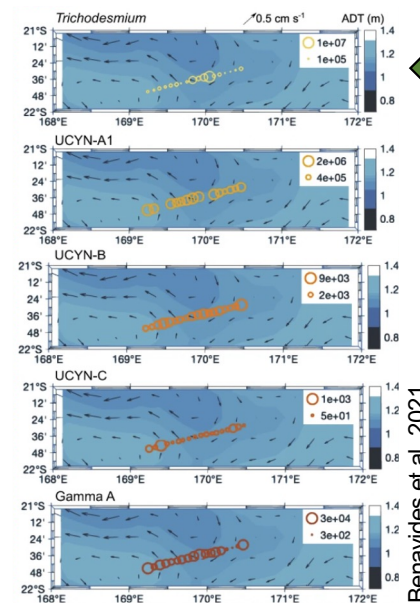
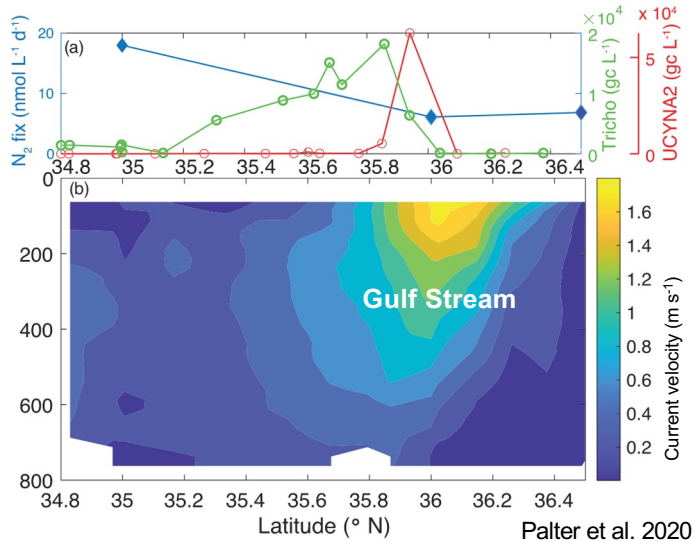
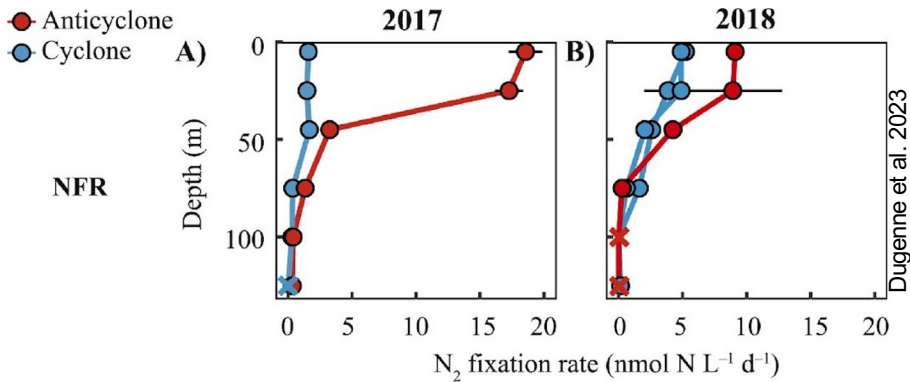
Active influences:
Altered environmental
conditions through e.g.,
nutrient input

Conceptual characteristics of cyclonic and anticyclonic eddies



Successional change of environmental conditions while carrying and trapping the water mass of origin

Effects of fine-scales on diazotroph abundance and activity



- Different diazotrophic taxa have different distribution across fine-scale structures
- N₂ fixation ≠ diazotroph abundance

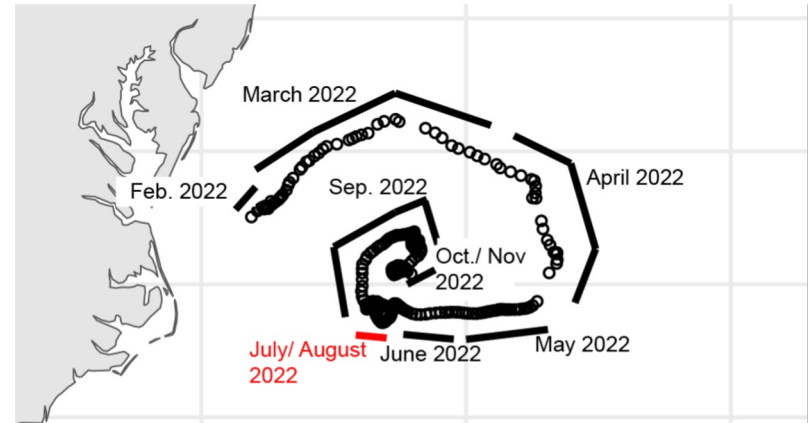
Hypothesis: fine-scale structures impact diazotroph communities and derived nitrogen inputs to the ocean

Active vs passive?

Gradients or ecological breakpoints across the Gulf Stream and eddies?

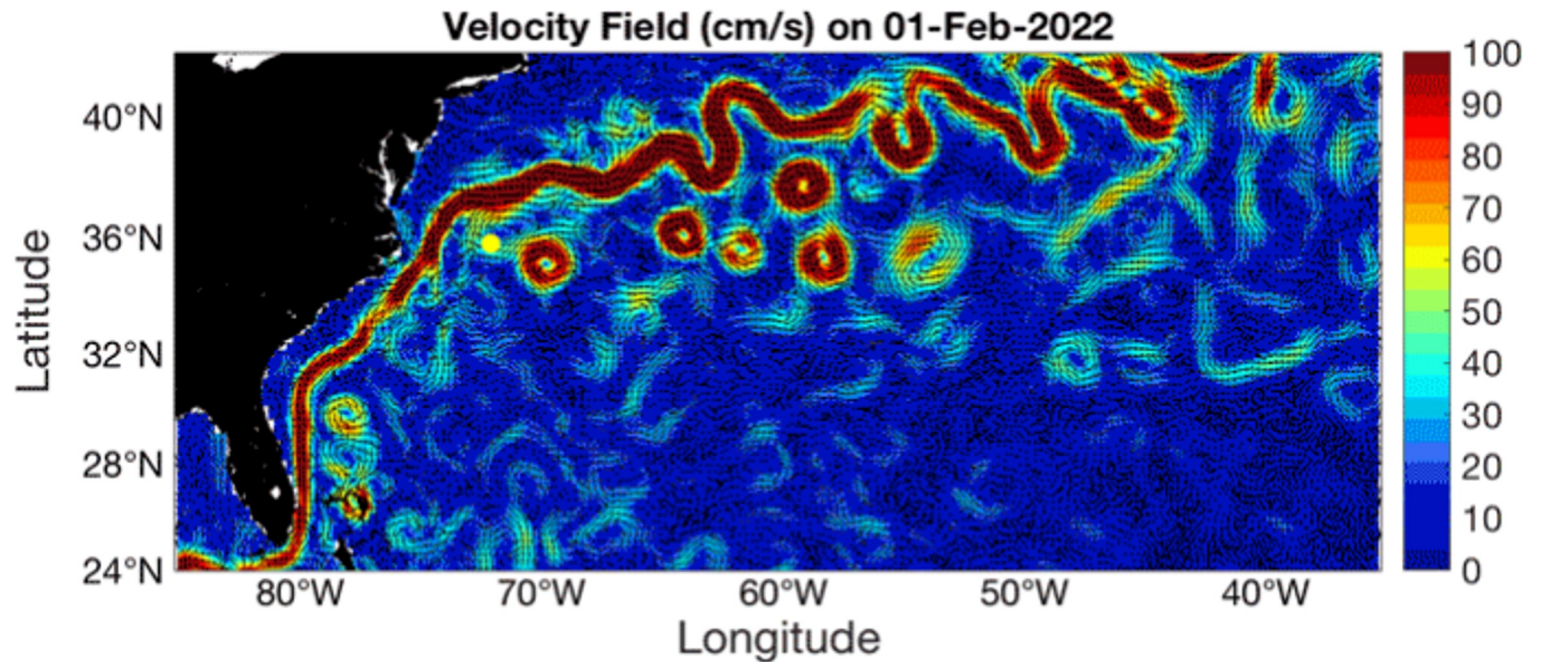
History of an eddy

typical cold-core Gulf Stream ring that originated east of the Gulf Stream trapping and shelf water of the Mid Atlantic Bight region in its core



Water mass origin sets diazotroph community trapped inside eddy

Impact on N_2 fixation?



Sampling design

● CTD stations + ● underway

$^{15}\text{N}_2$ incubation experiments 3 replicates
x 3-4 depths (CTD)

corresponding DNA samples (qPCR,
metabarcoding)

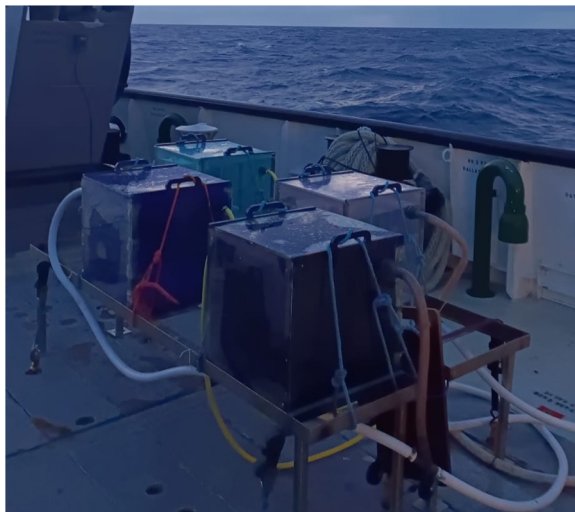
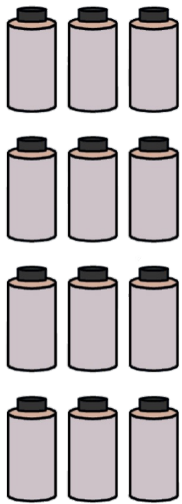
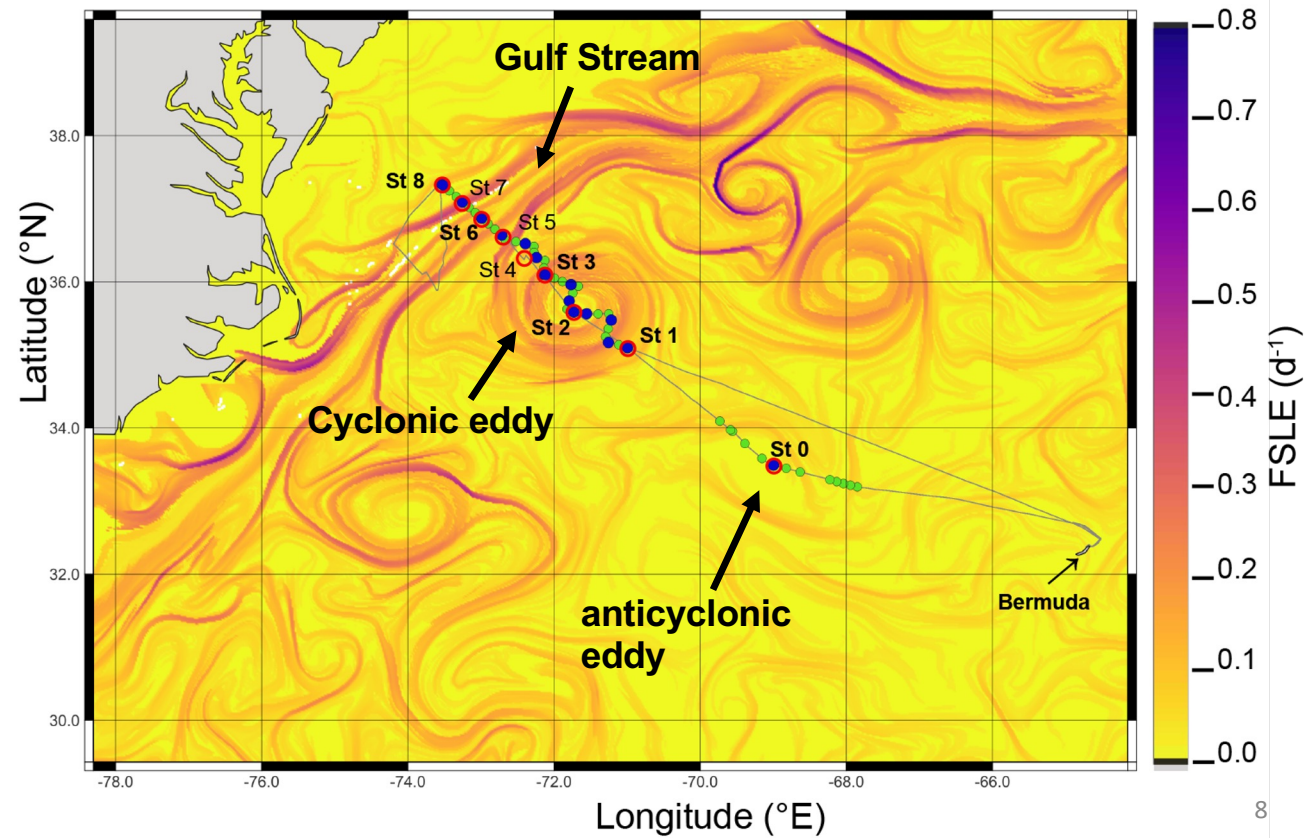
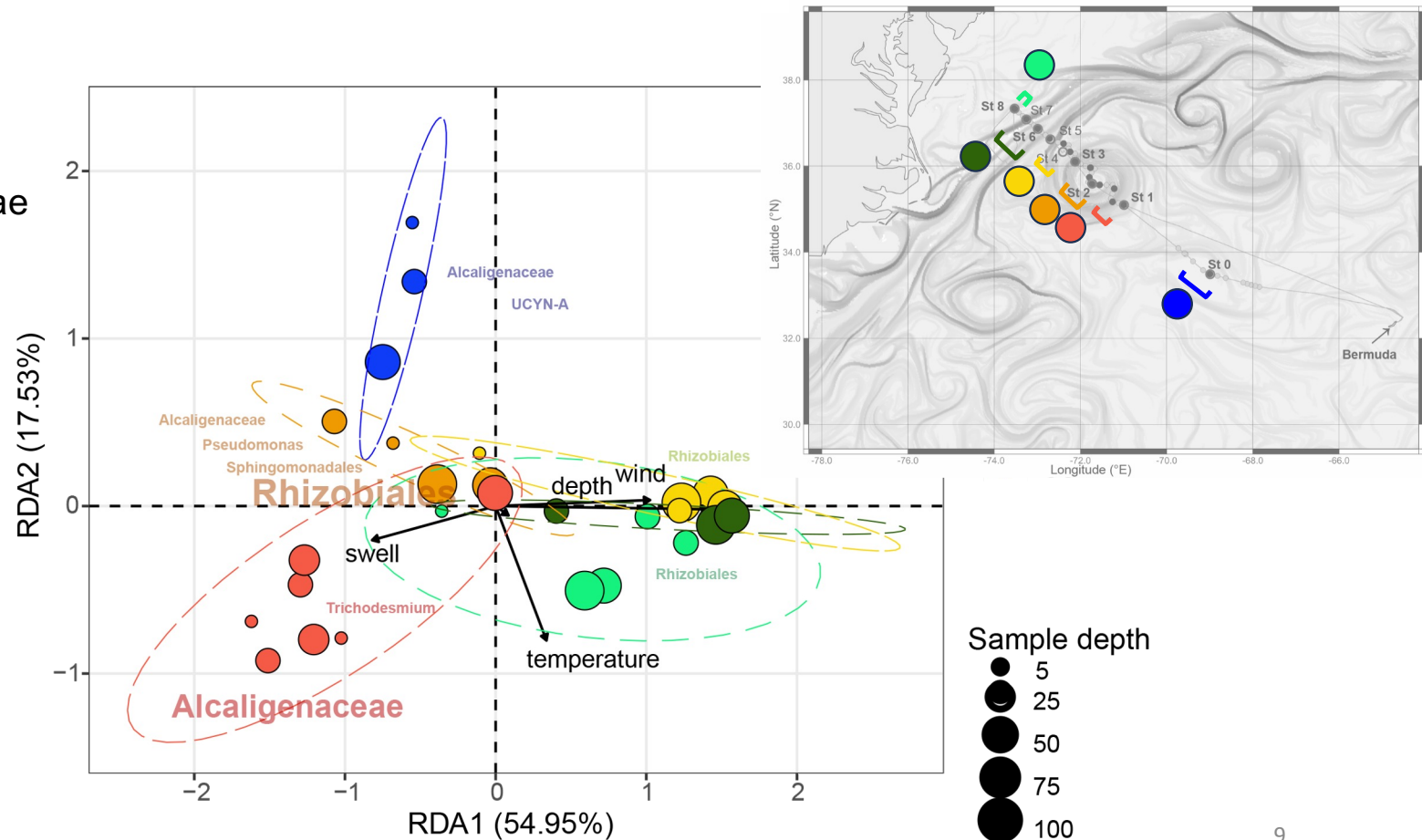


FIGURE-CARING cruise, July/ August 2022

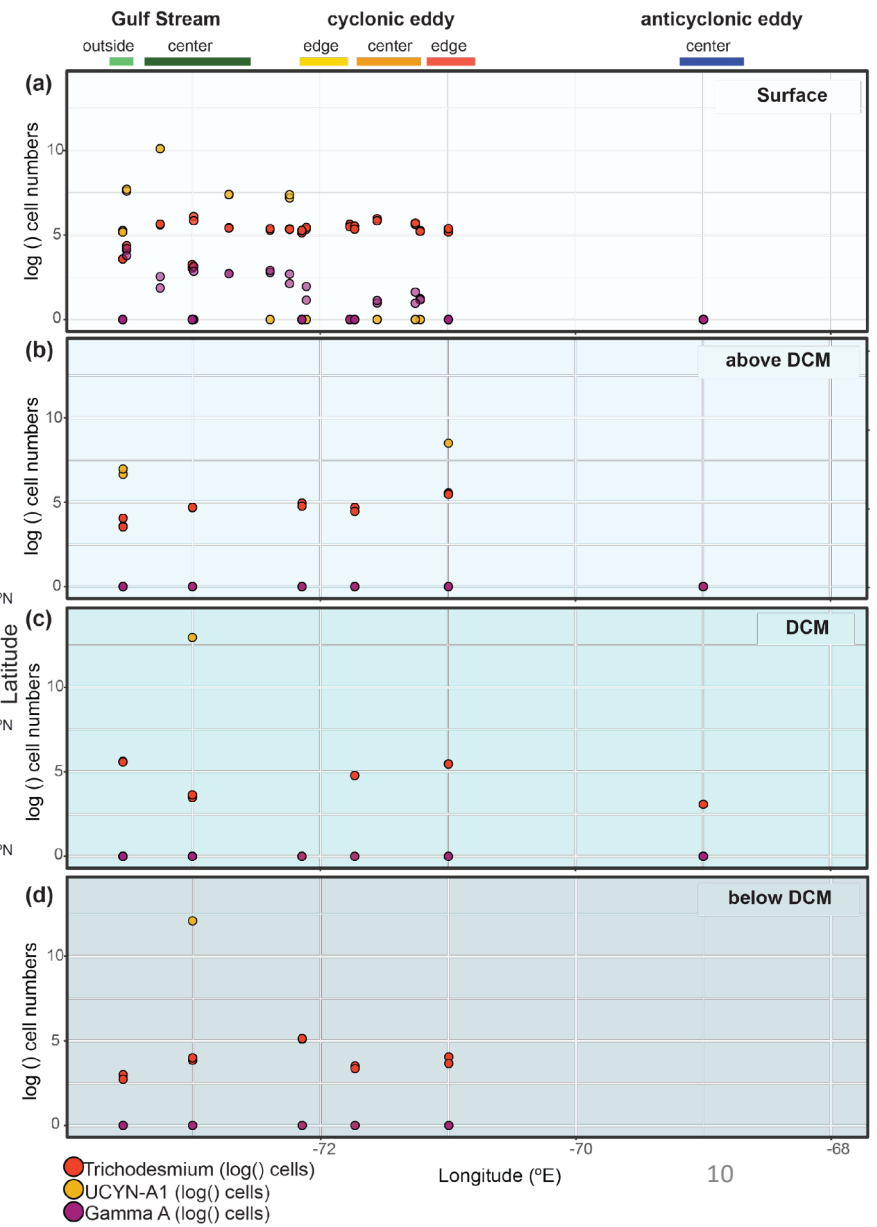
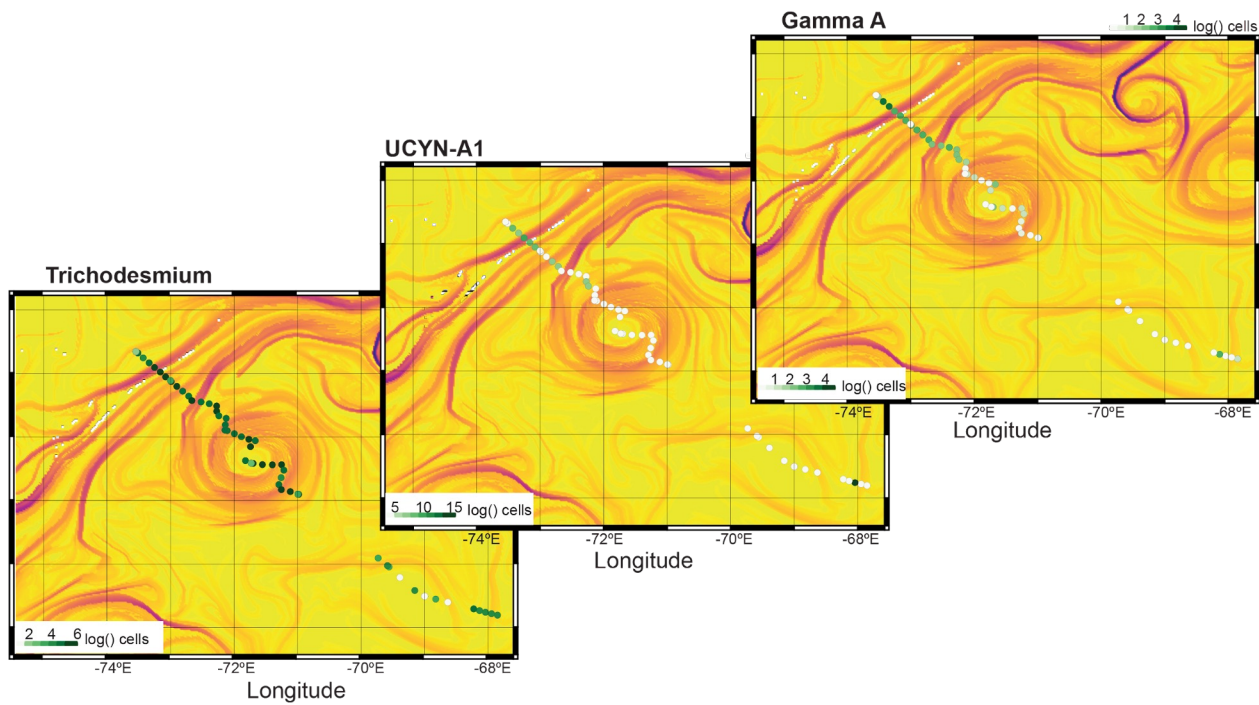


Diazotroph community composition (*nifH* gene amplicons)

- Differences between sites mainly due to different abundances of Alcaligenaceae and Rhizobiales
- UCYN-A associated with anticyclonic eddy
- *Trichodesmium* largely associated with the eastern edge of the cyclonic eddy, higher temperature and swell

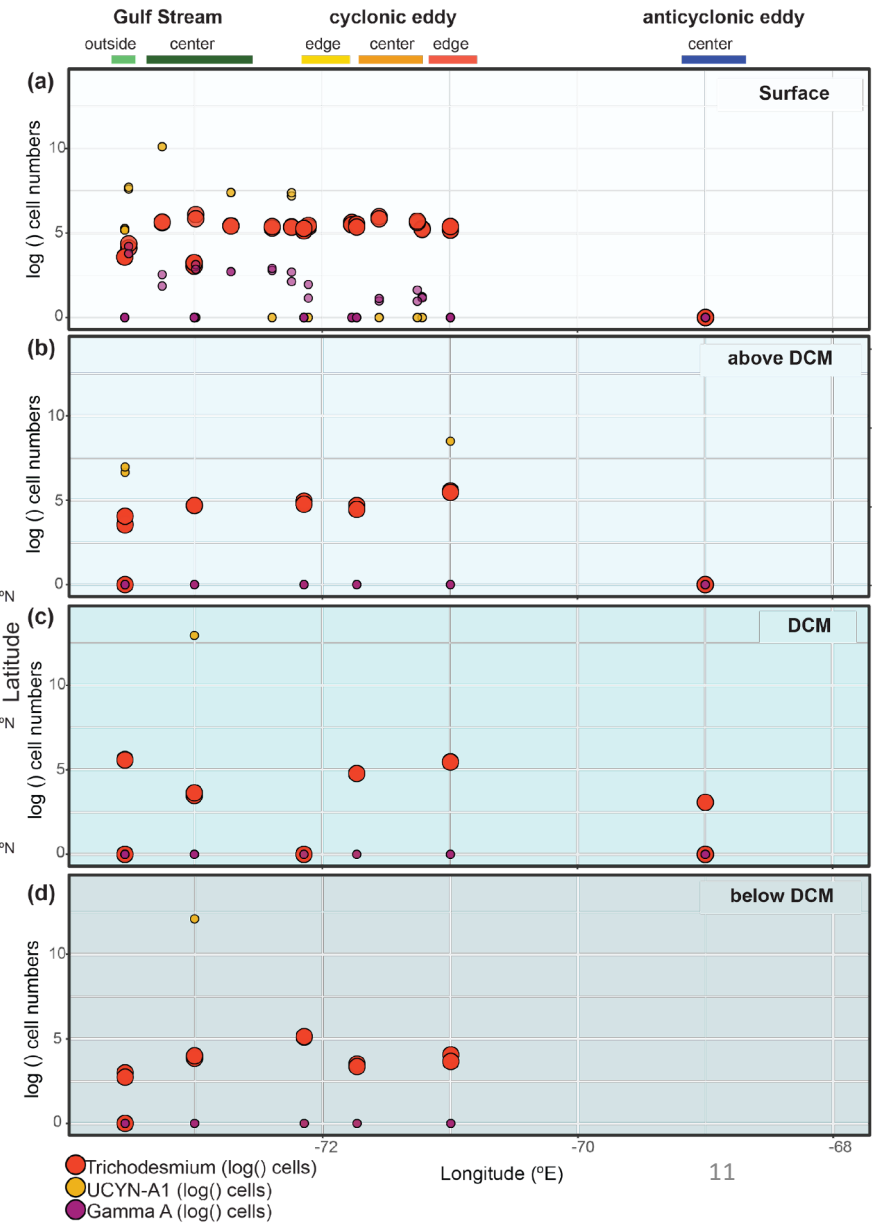
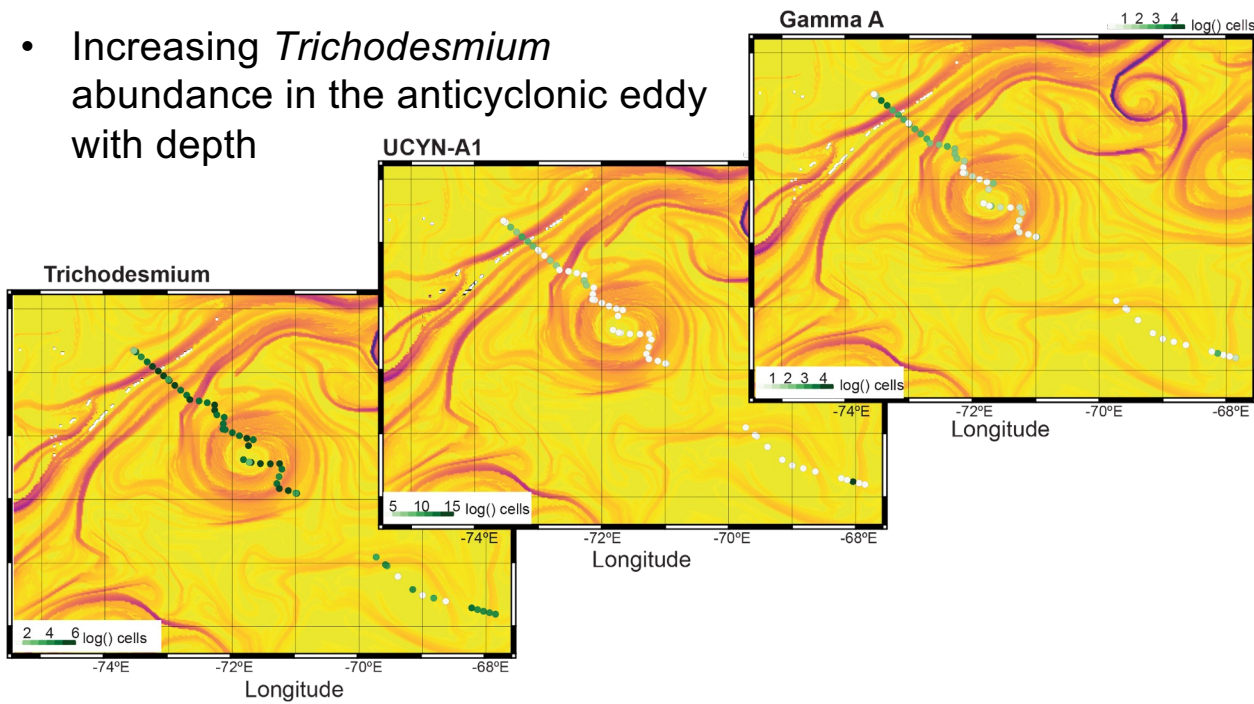


Diazotroph abundance over depth

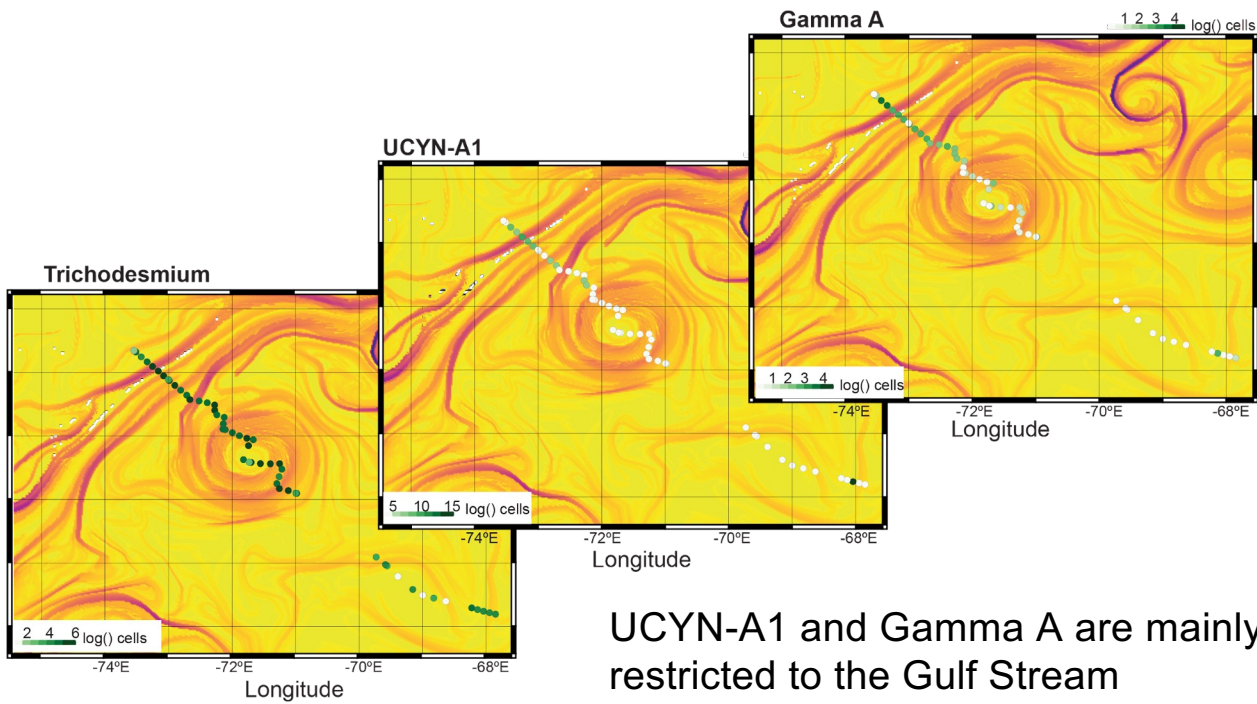


Diazotroph abundance over depth

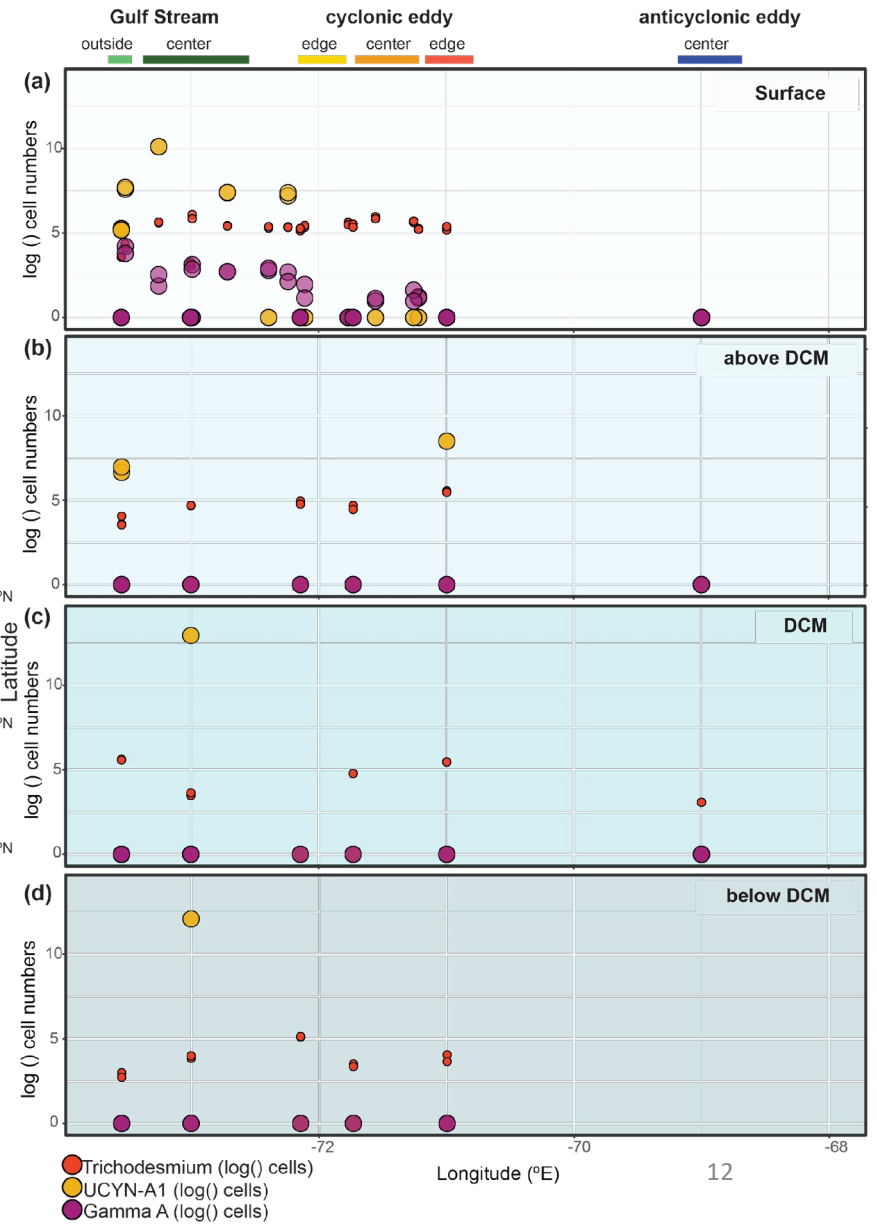
- *Trichodesmium* prevail across all samples
- Increasing *Trichodesmium* abundance in the anticyclonic eddy with depth



Diazotroph abundance over depth

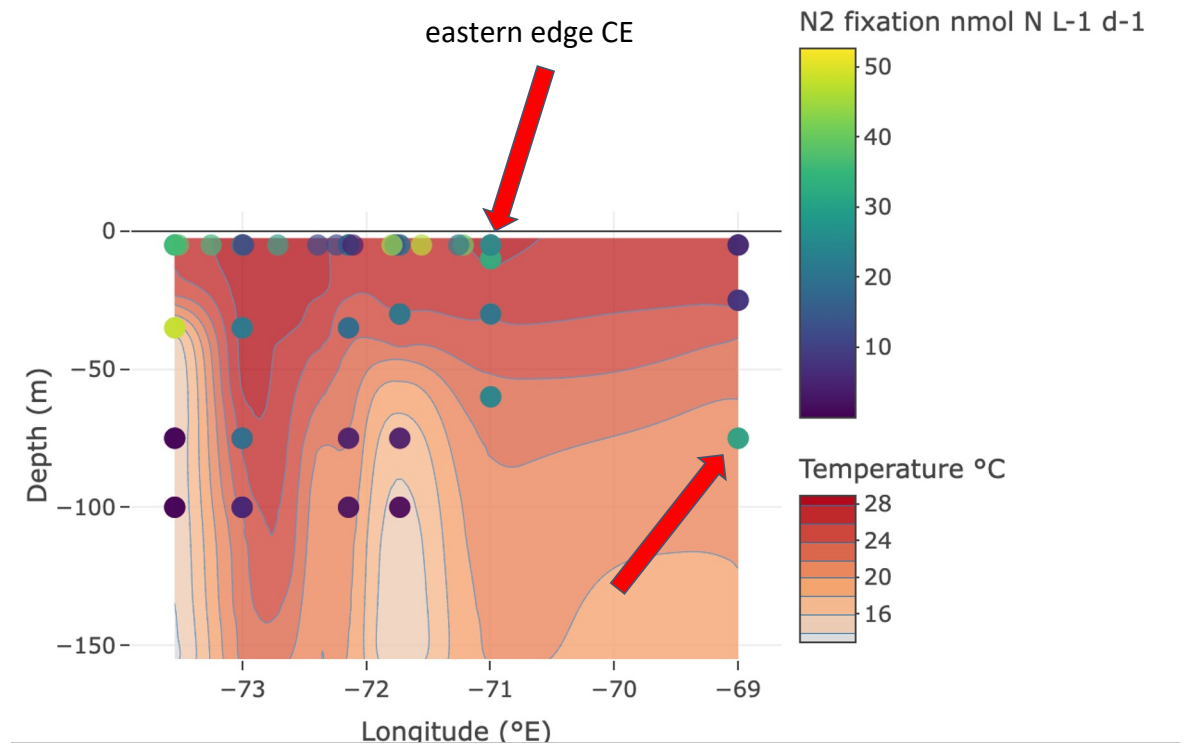


UCYN-A1 and Gamma A are mainly restricted to the Gulf Stream

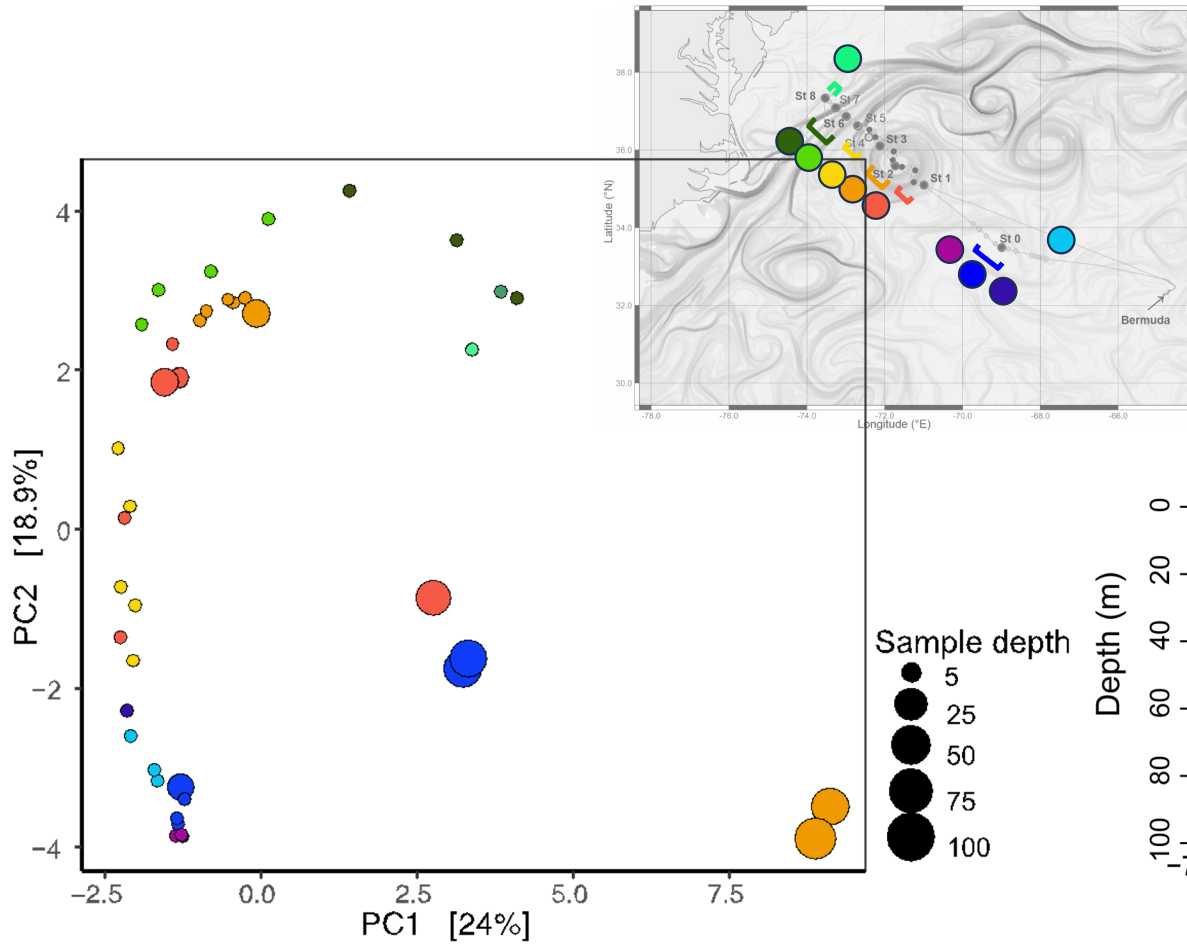


Living at the edge: N₂ fixation over depth

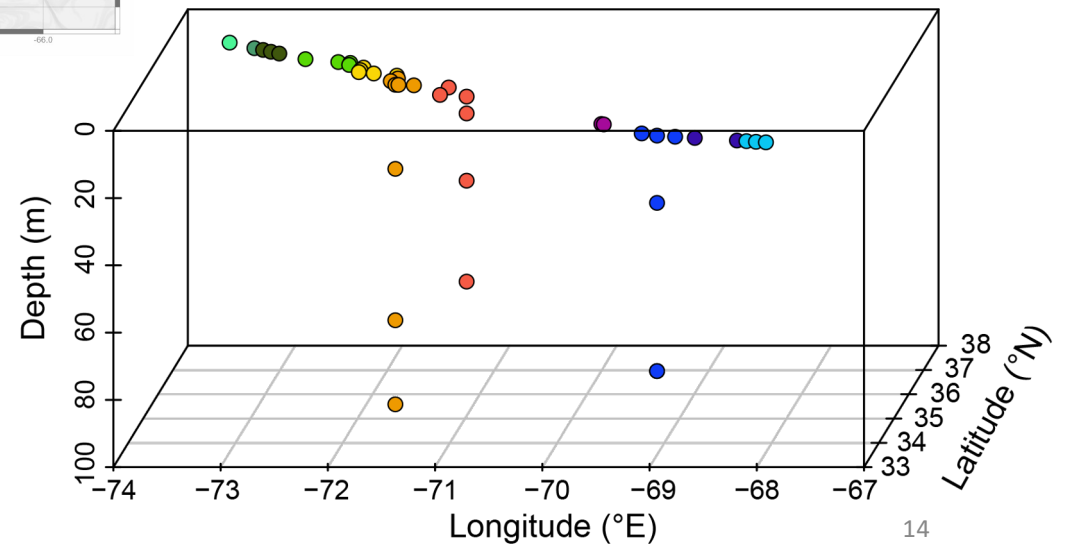
- Eastern edge of the cyclonic eddy was a hotspot for N₂ fixation
- Increasing N₂ fixation in the anticyclonic eddy with depth



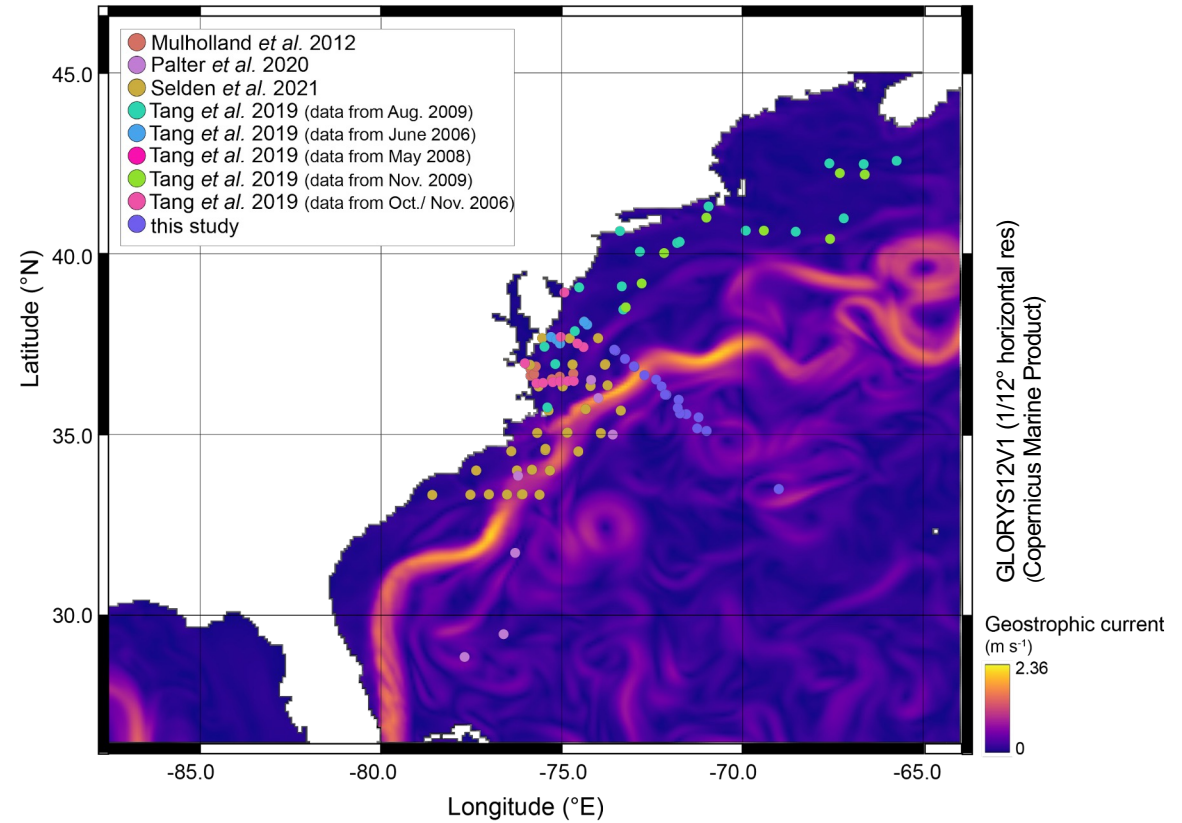
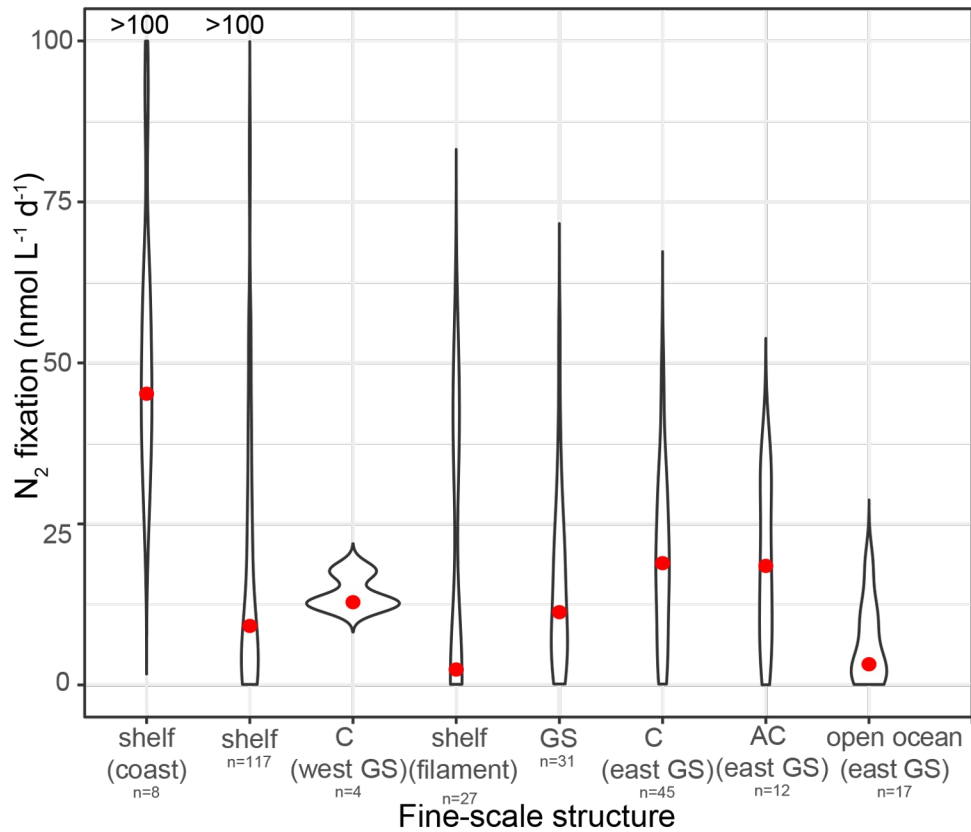
Water mass fingerprints (16S rRNA gene amplicons)



Connectivity between cyclonic and anticyclonic eddies

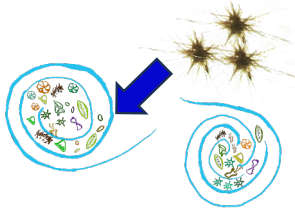


Variable N₂ fixation in fine-scale structures

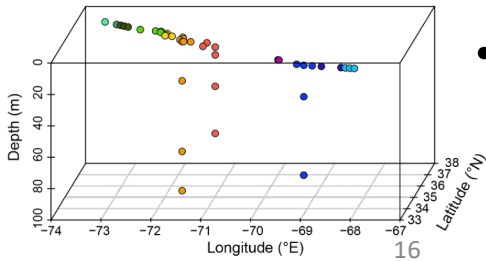


Eddies can contribute to new nitrogen input through elevated N₂ fixation

Summary and future directions



- Eastern Edge of the cyclonic eddy seems to be a hotspot for N_2 fixation, which was also associated with *Trichodesmium* abundance



- Potential connectivity between cyclonic and anticyclonic samples



- Eddies can generally contribute to new nitrogen input in the North Atlantic Ocean through elevated N_2 fixation

Acknowledgements



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FIGURE-CARING cruise team

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