

Microbial turnover of high molecular weight dissolved organic matter

Where are the roadblocks?



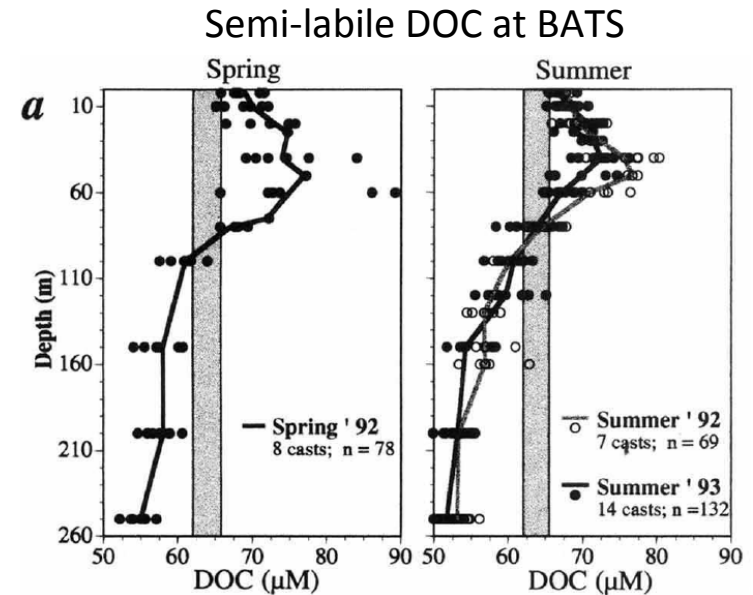
THE UNIVERSITY
of NORTH CAROLINA
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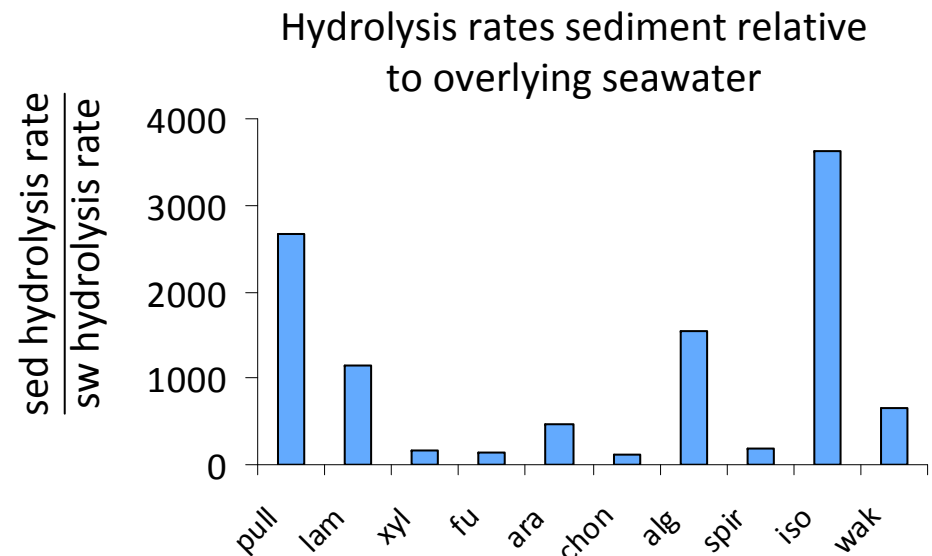
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Semi-labile DOC and extracellular enzymes

- Semi-labile DOC degrades over the timescale of seasons to a few years
- Major flux of semi-labile DOC from surface to deep water: \geq POC flux from euphotic zone
- Sediment and seawater microbial communities access different polysaccharides
- Could differences in ability to access specific polysaccharides among seawater communities lead to existence of semi-labile DOC?



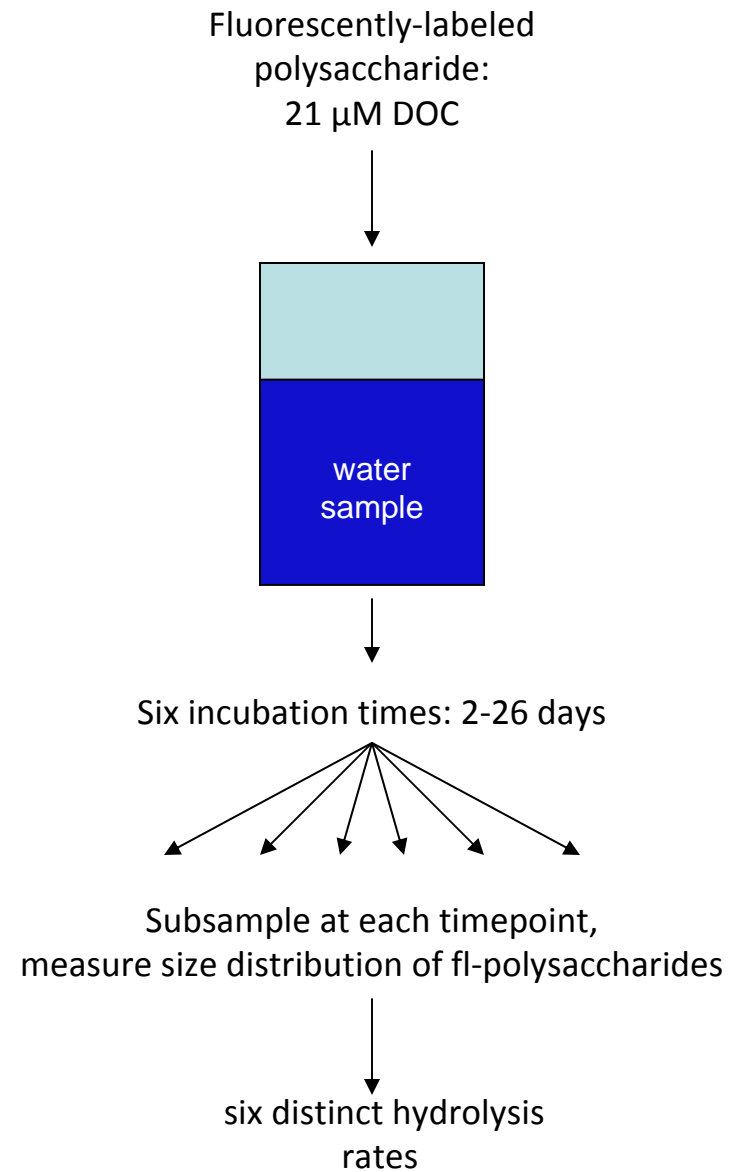
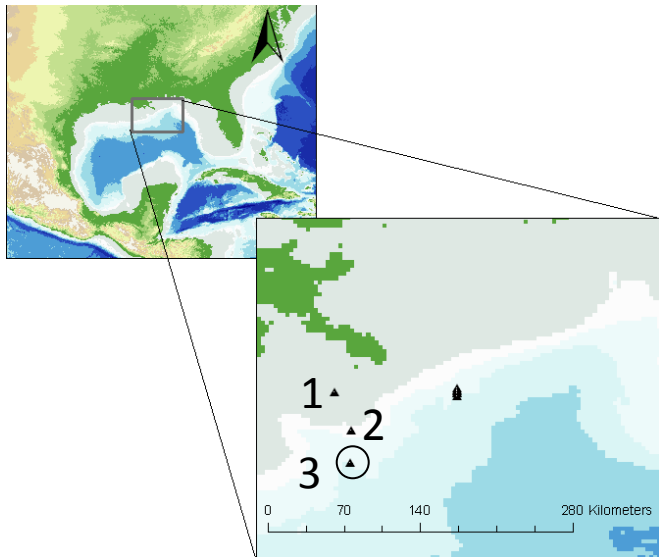
Carlson, Ducklow, Michaels 1994
Nature, 371: 405-408



replotted from Arnosti 2008
FEMS Microbio. Ecol. 66: 343-351

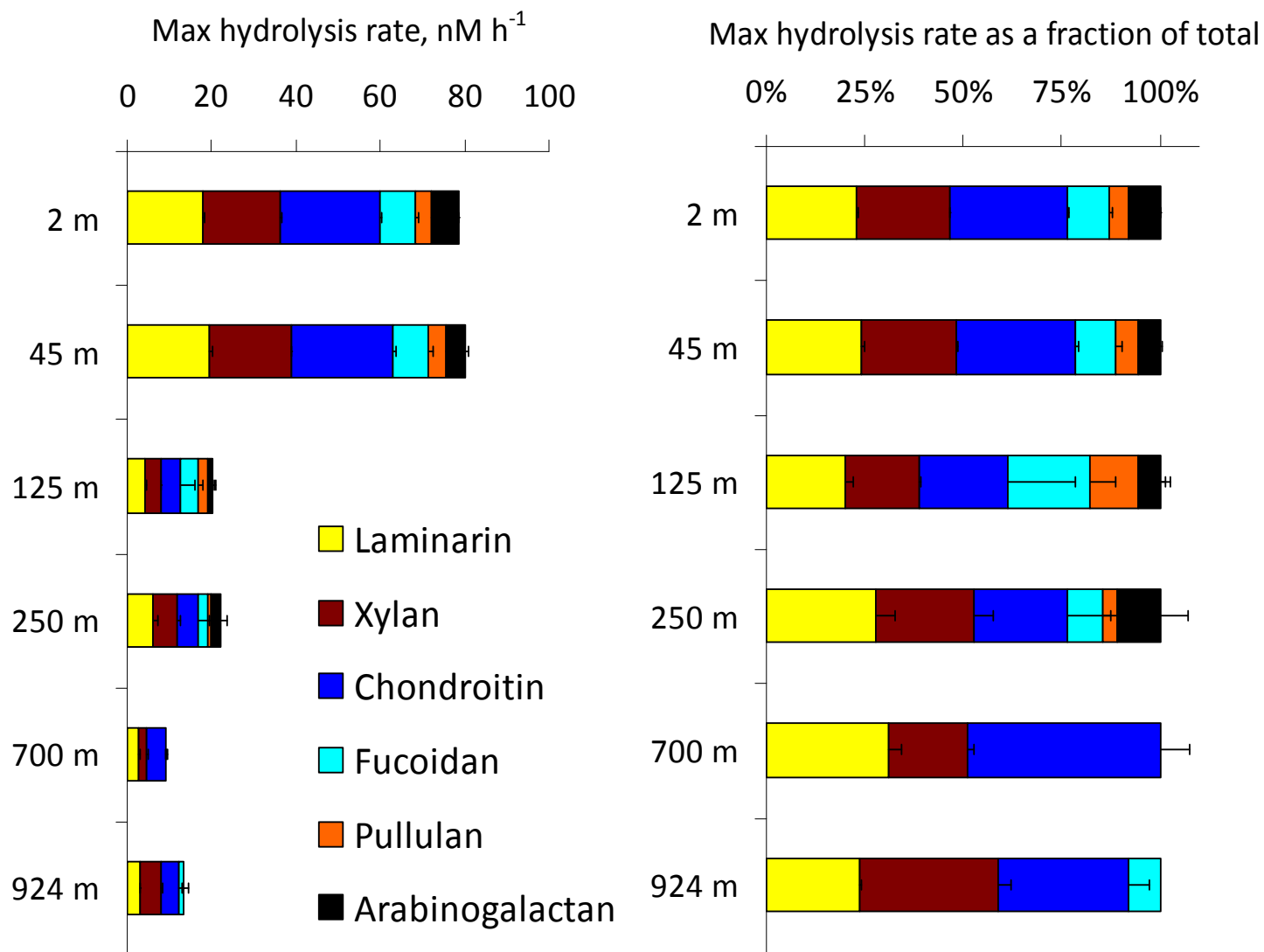
Polysaccharide hydrolysis rates in the Gulf of Mexico, September 2007

- Measure hydrolysis rates of six different polysaccharides
- How does community function (seen as ability to access polysaccharides) vary with site and depth?



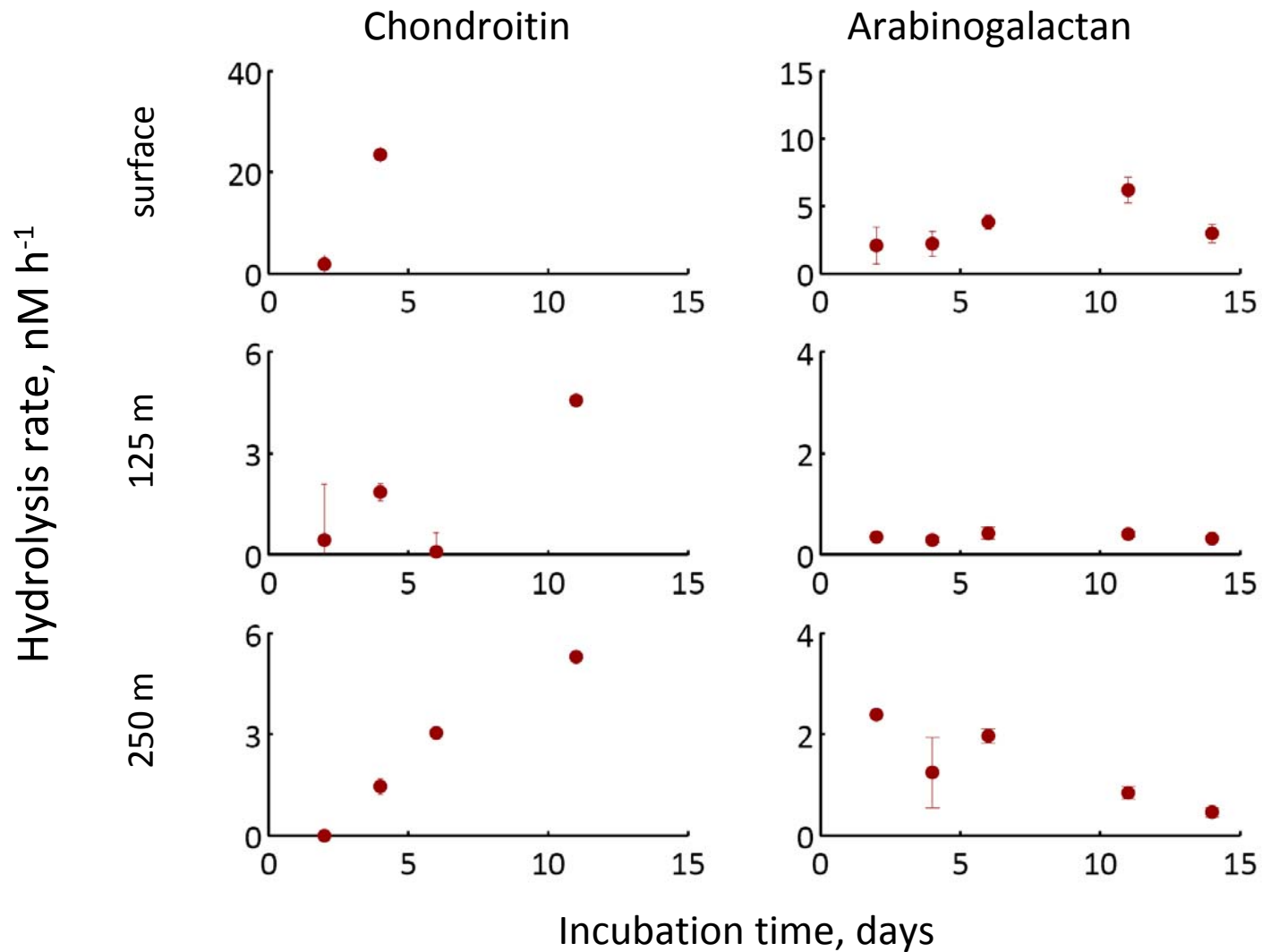
Station 3 (offshore)

hydrolysis rates



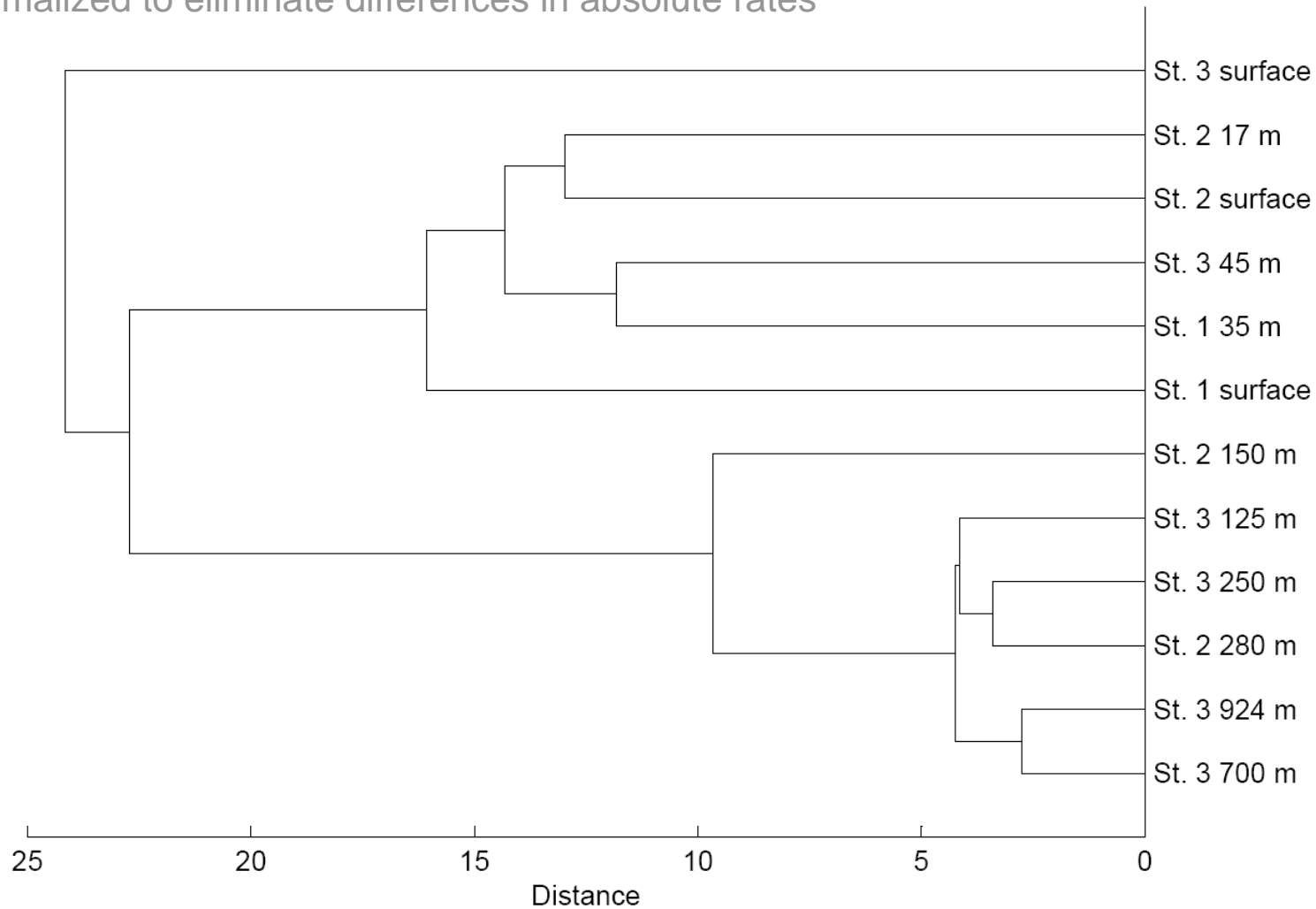
Hydrolysis rates as a function of incubation time

“Sleeping” communities at depth



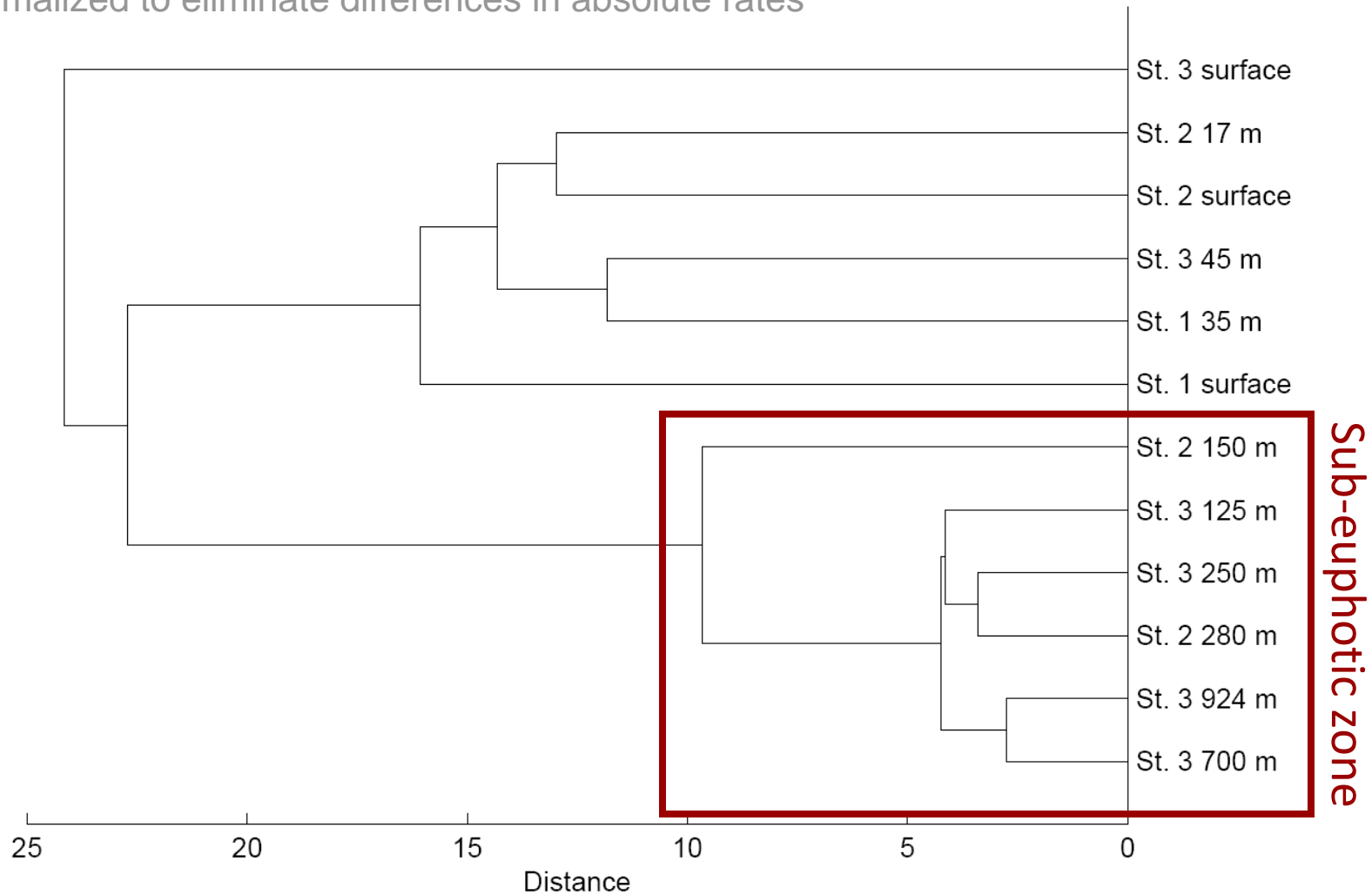
...But “sleeping” communities have fundamentally different function than surface communities

Dendrogram of rate patterns by station, normalized to eliminate differences in absolute rates



...But “sleeping” communities have fundamentally different function than surface communities

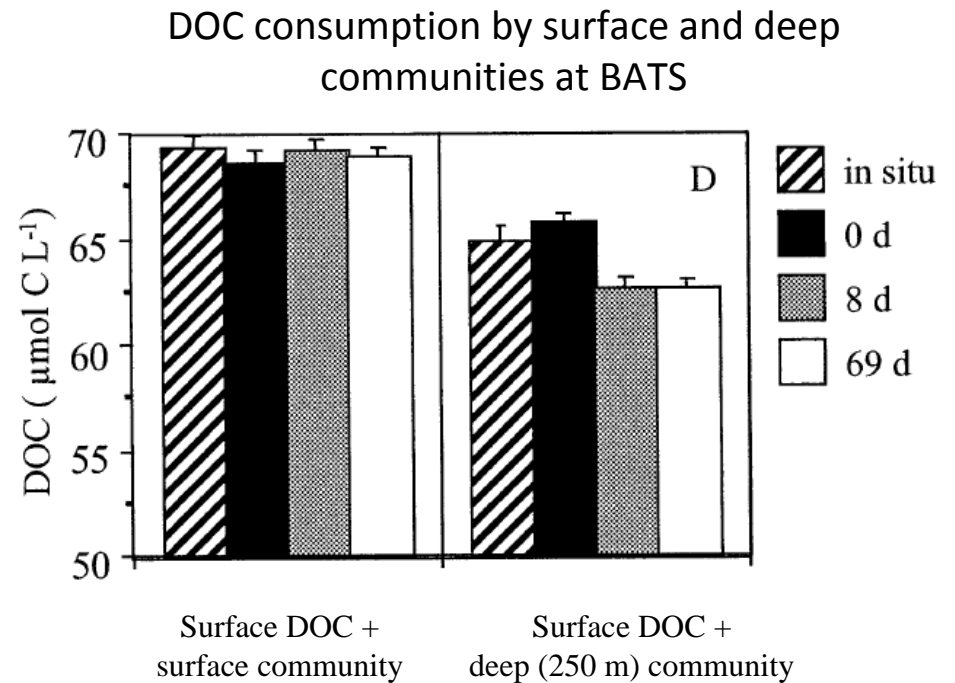
Dendrogram of rate patterns by station, normalized to eliminate differences in absolute rates



Conclusions

Patterns of extracellular enzyme activity could influence export of semi-labile DOC

- Expression of extracellular enzymes between deep and surface communities in *nature*, not just *quantity*
- Lability of DOC is not a purely chemical quality: composition of microbial community matters too



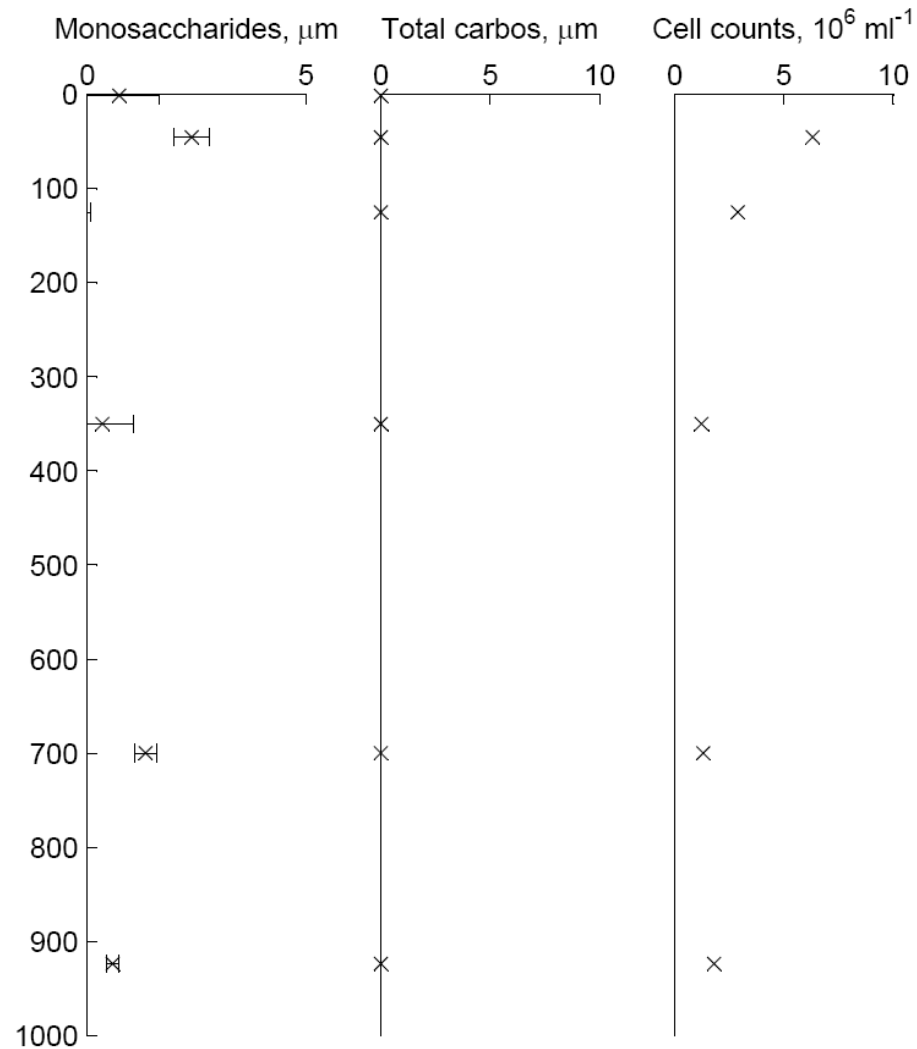
Carlson et al (2004) L&O 49(4)
1073-1083

Acknowledgements

- EPA STAR graduate fellowship
- NSF OCE grants
- Duke/UNC Oceanographic Consortium (DUNCOC) & the State of North Carolina
- Captain and crew of R/V Cape Hatteras
- Entire Arnosti lab (with undergrads!)



Carbos and cell count data

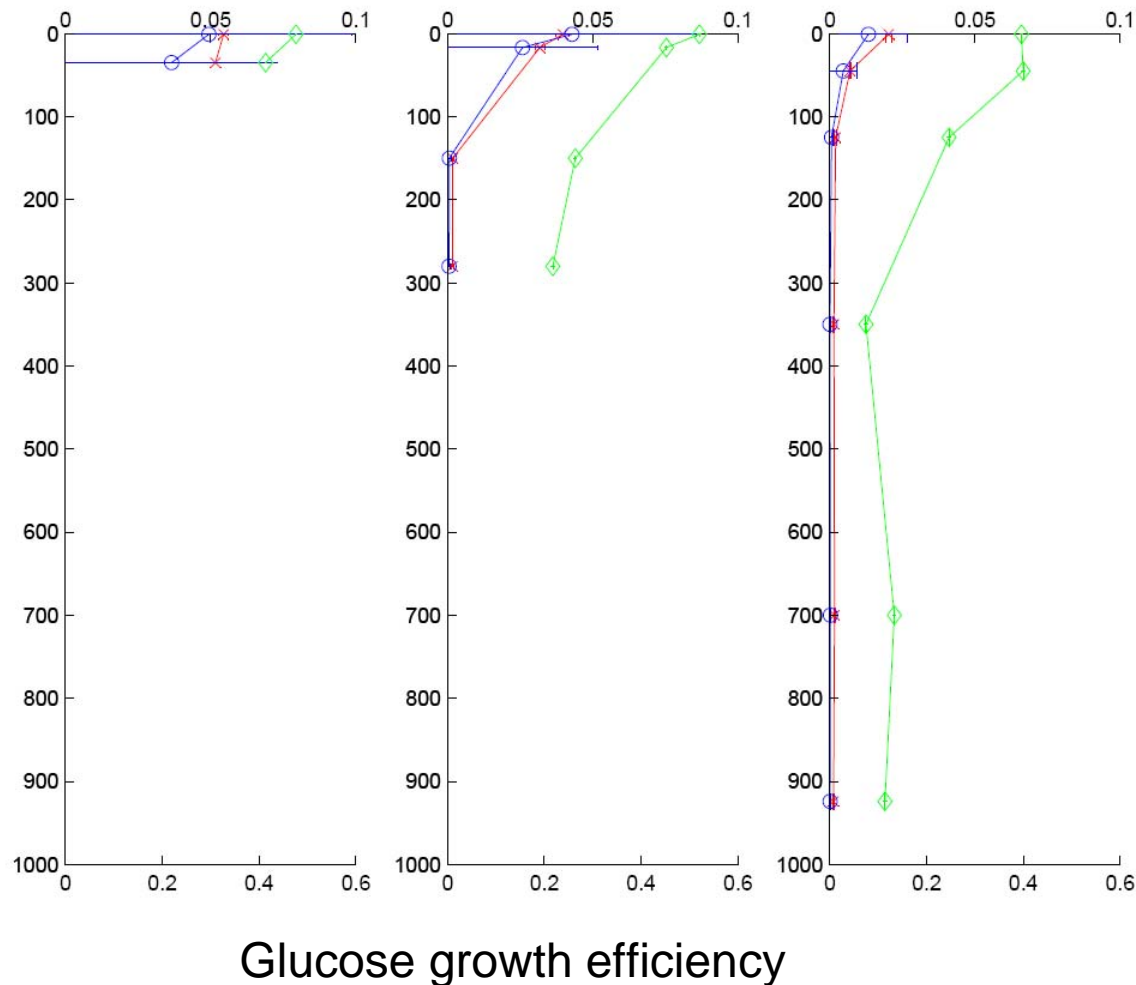


Not really sure
what to do with this

Haven't made
TCHO
measurements yet

Radiotracer data: “Sleeping” communities in deep water

Fractional glucose assim (blue) or remin (red)



Note that glucose assimilation (blue) and respiration (red) rates decrease rather more steeply than the hydrolysis rates do. I interpret this to indicate that the communities in deeper water retain the potential to hydrolyze polysaccharides, if they are present for long enough, even as the actual activity of the community (measured by glucose uptake) decreases pretty rapidly

GOM background data

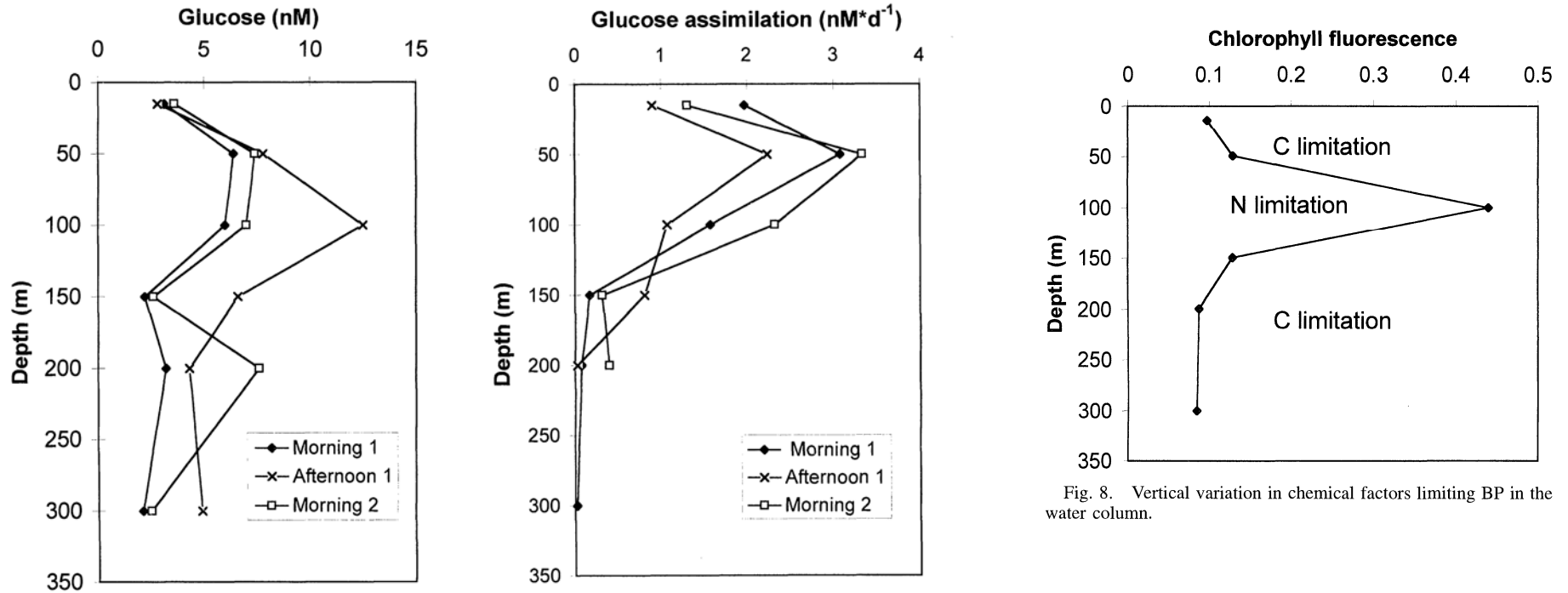


Fig. 1. Glucose concentrations and assimilation in the upper 300 m. Morning 1 and afternoon 1 are samples from the same day, and morning 2 are samples from the following day.

Fig. 8. Vertical variation in chemical factors limiting BP in the water column.