

No N₂ fixation in the Bay of Bengal? -An OMZ at a tipping point-

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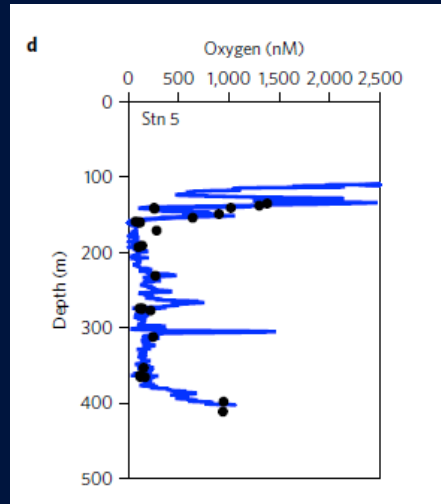
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The Bay of Bengal (BoB) has a special oxygen minimum zone, with extremely low, but persistent, concentrations of oxygen in the nanomolar range which – for some, yet unconstrained, reason – are prevented from becoming anoxic.

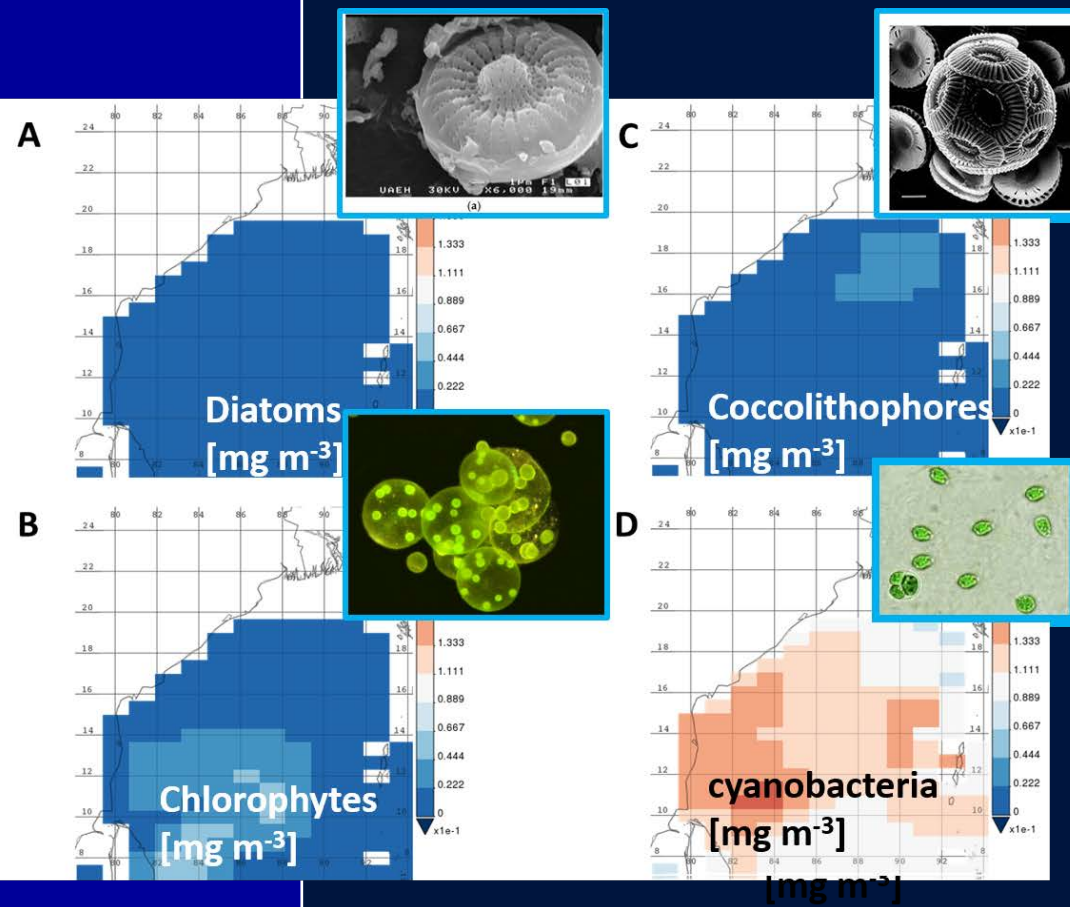
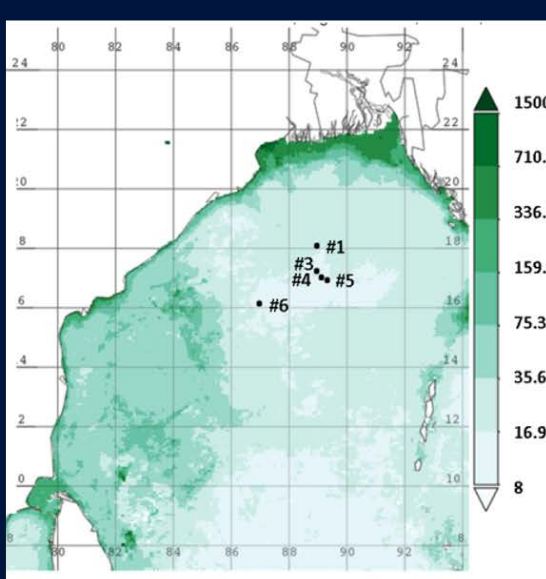


Bristow et al., 2017

Why is that?

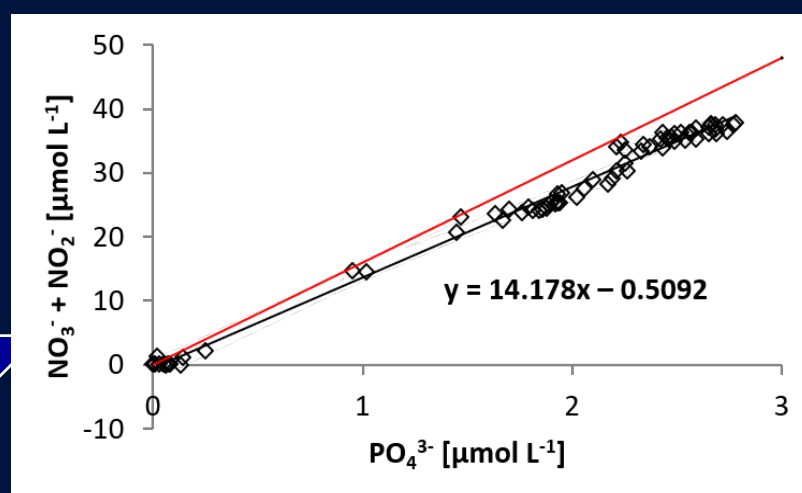
Low primary production, mostly by small cyanobacteria (Prochlorococcus, Synechococcus)
Low export production
Low respiration

Chlorophyll a [10^{-2} mg m⁻³]

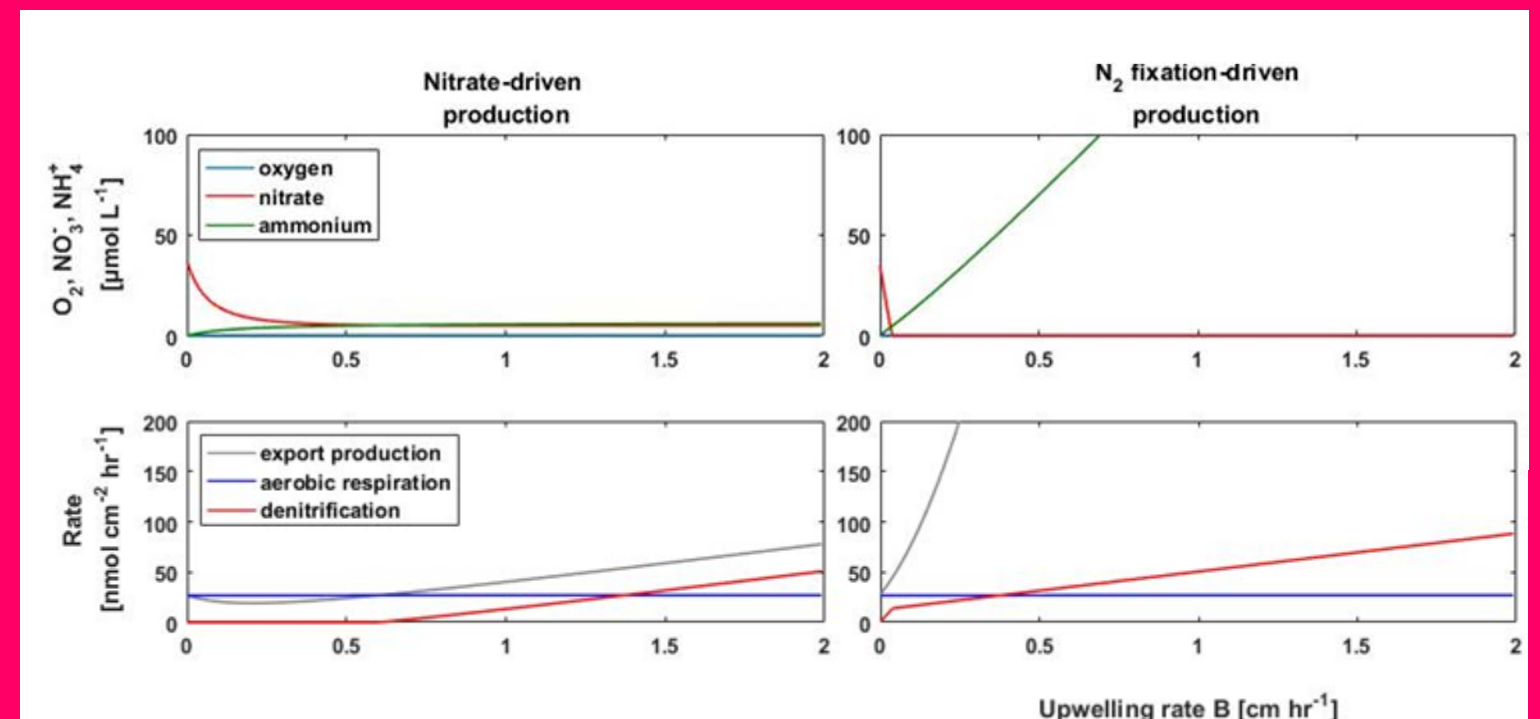
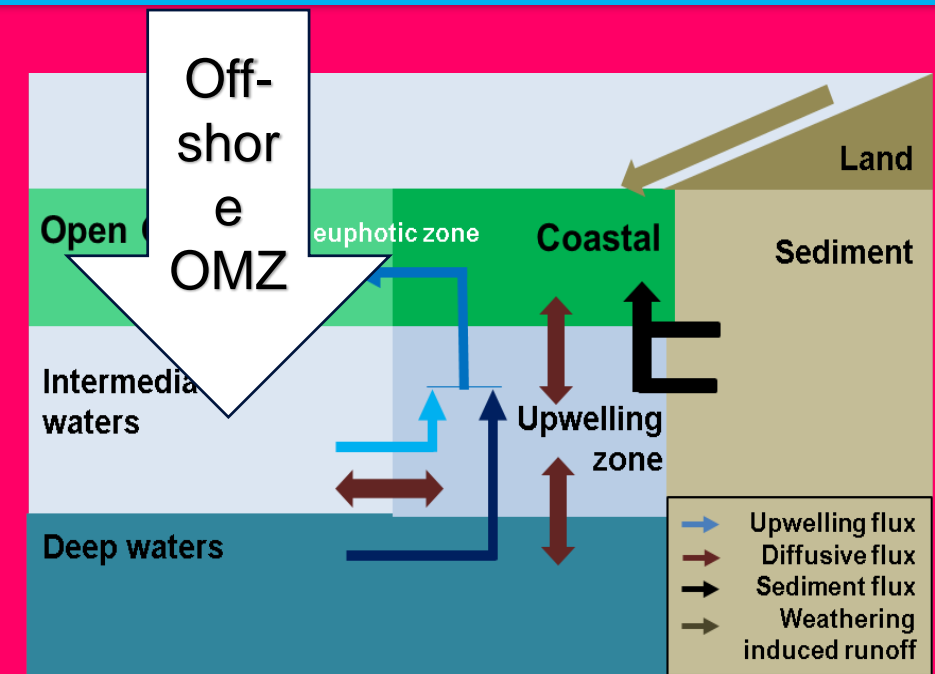


What limits primary production?

The case for N limitation: the strong stratification limits nutrient supply via upwelling in the open waters, and riverine or atmospheric fluxes have been shown to support only less than one-quarter of the nitrogen for primary production.



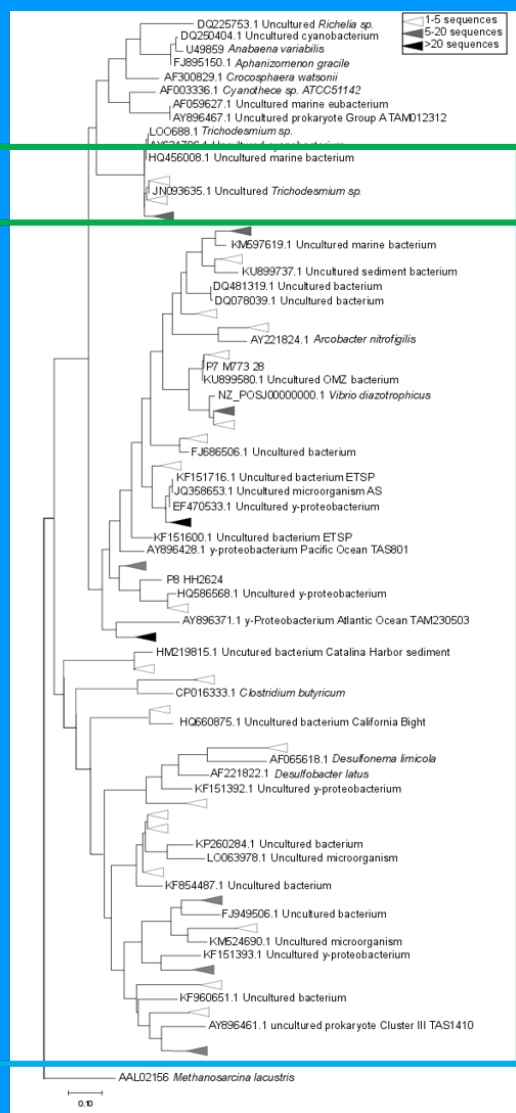
Does the absence of N₂ fixation contribute to the BoB not developing strict anoxia??



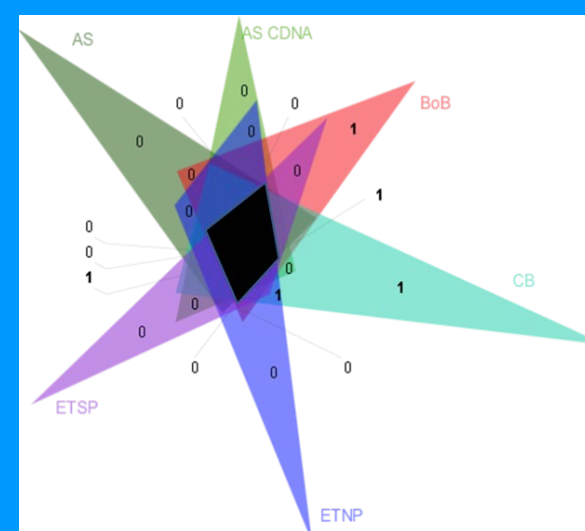
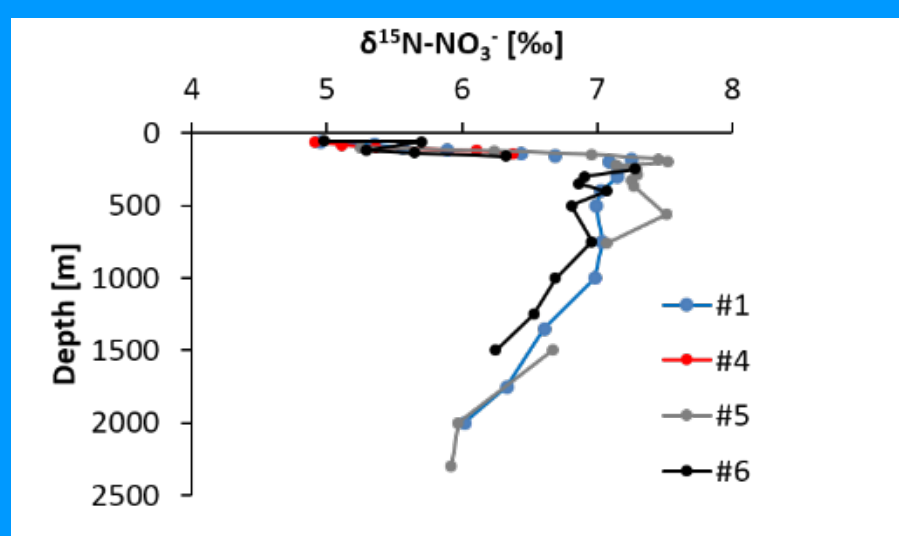
N₂ fixation very sensitive to even minimal changes in water column stratification
mixing → N₂ fixation → O₂ exhaustion

Feedback between OMZ intensity and N₂ fixation would lead to full anoxia

What about N₂ fixation?



Typical OMZ N₂ fixers are there but no N₂ fixation: no detectable rate, no indication from isotopes



Why don't they fix N₂?

The N₂ fixers are heterotrophs and inhabit the OMZ
They may be strict anaerobes

Similar communities of N₂ fixers were shown to actively fix N₂ in other OMZs

Sensitive to O₂?
Limited by trace metals?
Limited by organic matter?