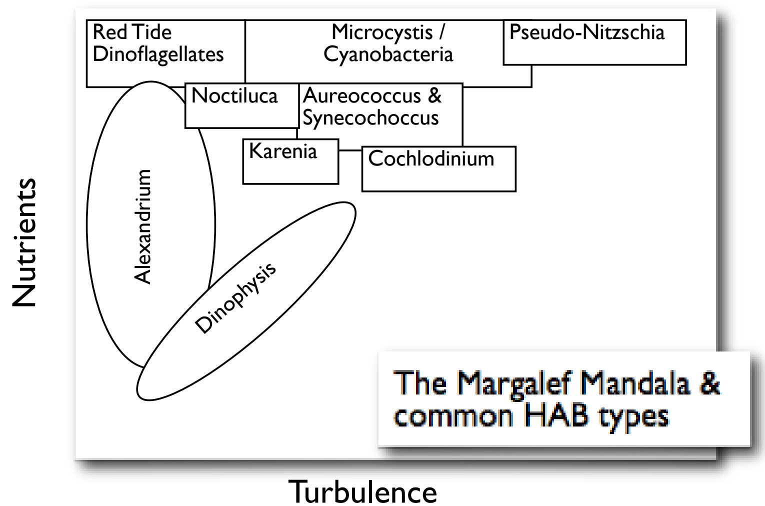
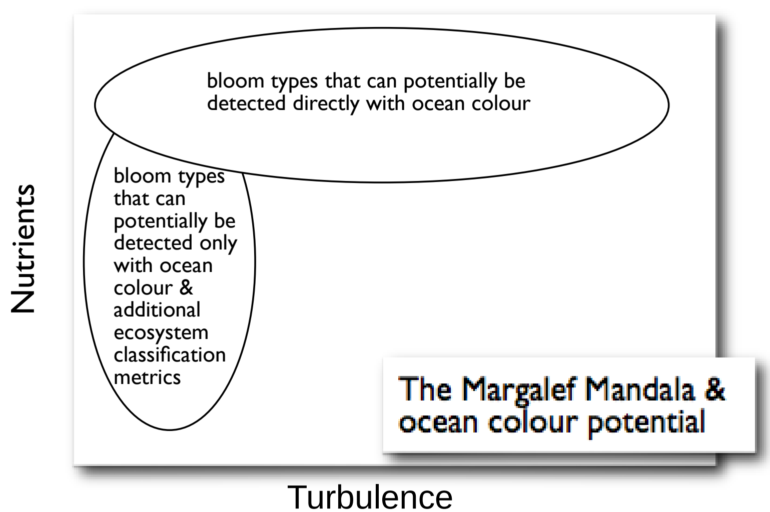
# Breakout WS 2: Going beyond HPLC: Coming to rapid consensus on science requirements for assessing phytoplankton composition from satellite imagery

Detection of phytoplankton blooms of specific groups and species

Discussion starter….




## The Ecosystem Perspective

The Margalef mandala is a common way of examining algal succession by characterising the ecological niche in which different species or groups are most likely to proliferate.

Many harmful algal species can have impact at very low cell concentrations, as a minor component of the algal assemblage, or as subsurface blooms with no bio-optical surface expression.

Viewing the mandala from an ocean colour perspective, it is clear that only high nutrient-demand/biomass blooms are likely to be *directly* detectable using ocean colour - regardless of the algorithm type or technique used.

Using ocean colour as one component of a multi-parameter ecosystem classification – effectively using the mandala to create an earth observation based metric – will potentially allow the detection of some other bloom types.

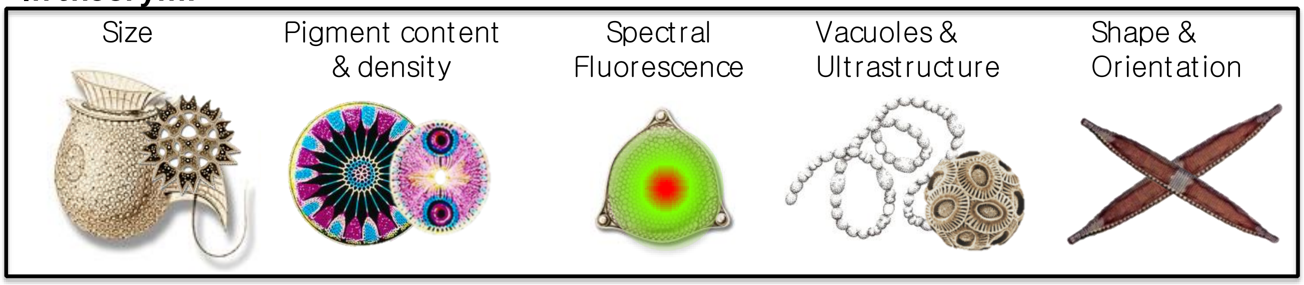
Some material from the IOCCG HAB WG draft monograph....

# International Ocean Colour Science Meeting 2019

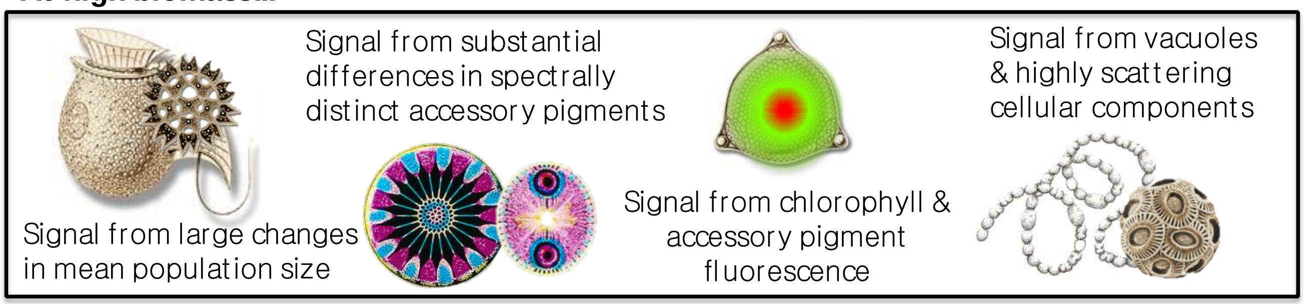
Advancing Global Ocean Colour Observations

The properties of the phytoplankton community that affect ocean colour…

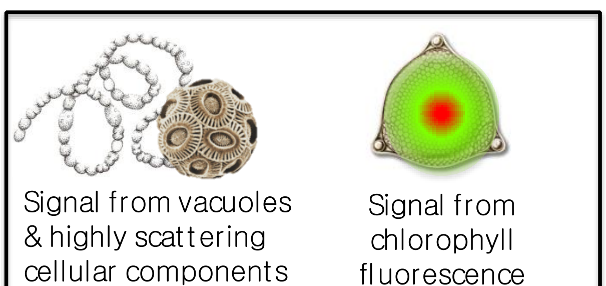
**In theory….**




**At high biomass...**




**At low biomass….**

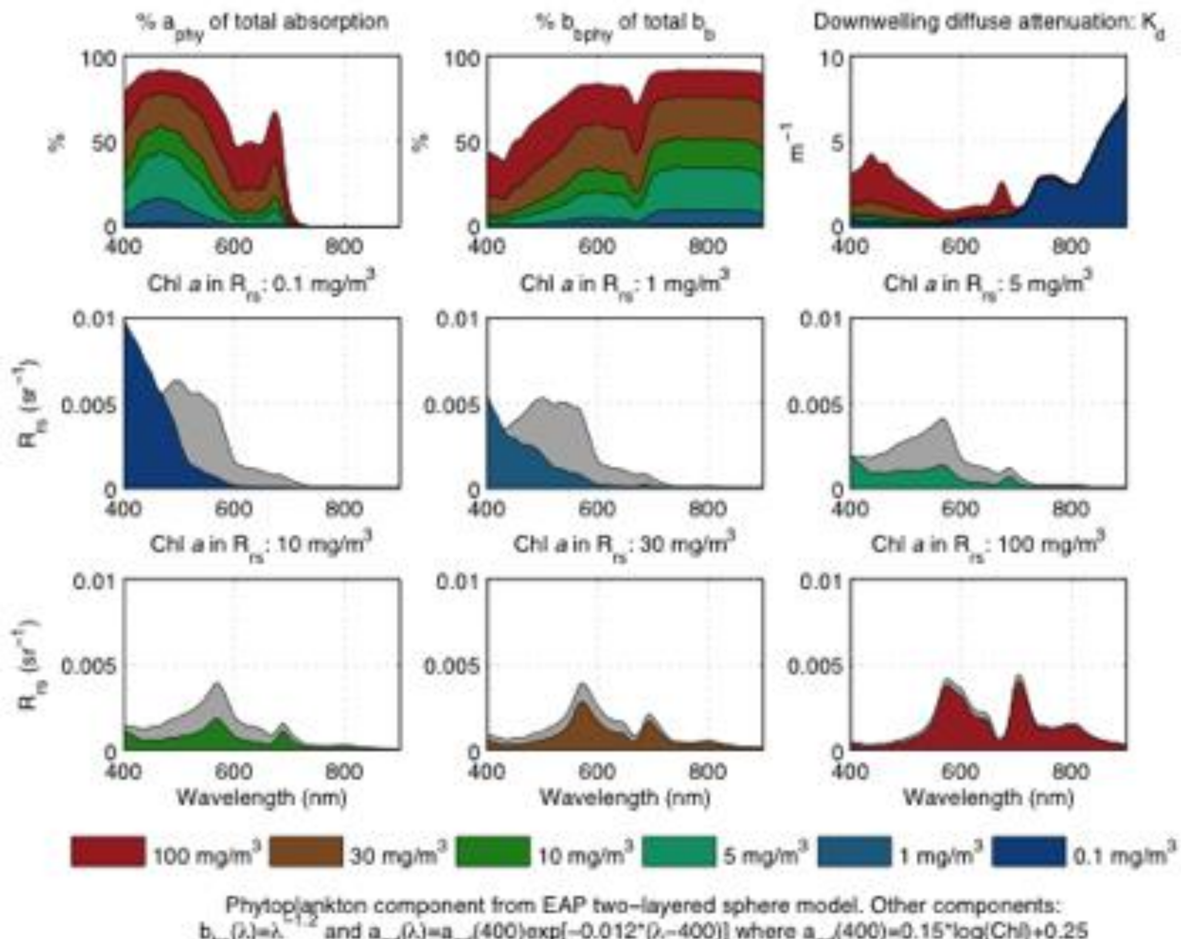



**In Case 2 type waters...**

Highly dependent on the relative IOP contribution….

…from the IOCCG HAB WG draft monograph….

Important to understand that phytoplankton biomass and the relative phytoplankton contribution to the IOP budget are critical to assessing second-order community-structure related effects on the spectral light field….




...from the IOCCG HAB WG draft monograph....

...and that the relative contribution of phytoplankon IOPS is the key driver of the community related signal in the spectral reflectance... spectral backscatter in the green is of particular importance

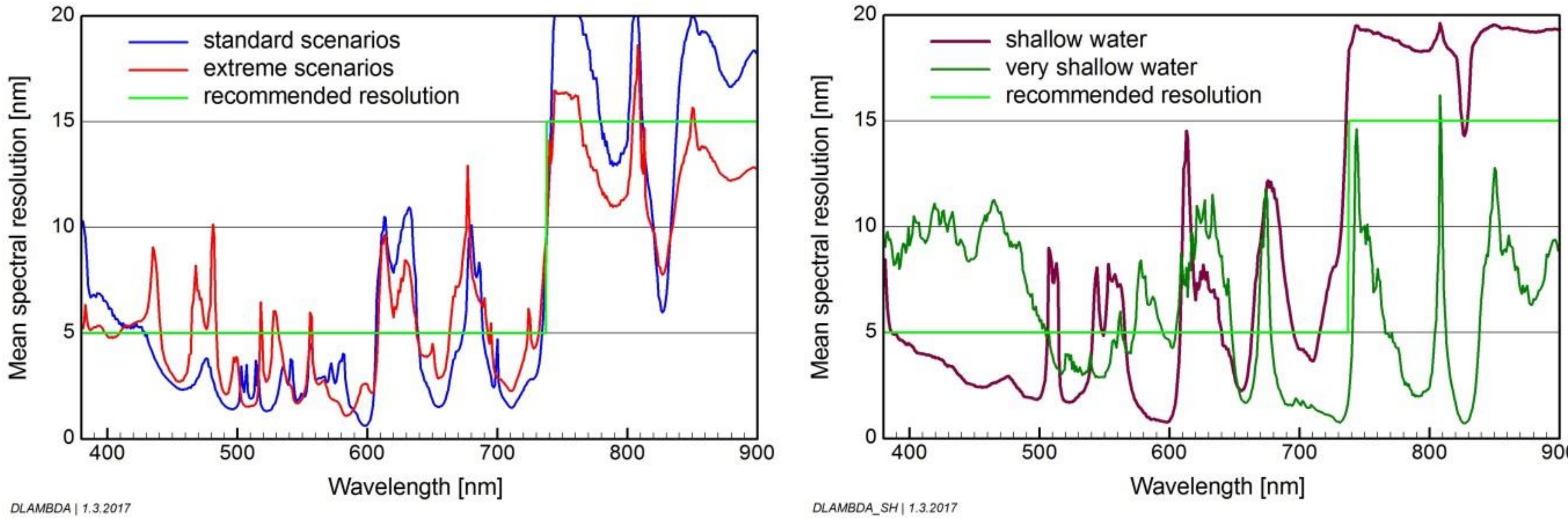
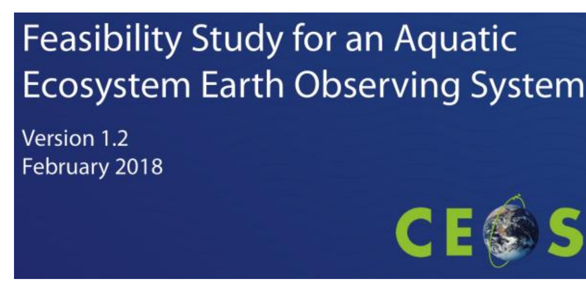



**Figure 34: Averages of optimal spectral resolutions. Left: for optically deep water. Right: for optically shallow water.**

The quantitative hyperspectral vs mutispectral case is a complex one, requiring systematic evaluation over a wide range of water types, focusing on a matrix of co-varying target variables, using both multi-spectral and spectrally dense analyses. An example focusing on spectral resolution requirements - how spectrally dense must the hyper be to offer quantitative advantage? Dekker et al 2018.


Feasibility Study for an Aquatic Ecosystem Earth Observing System

Version 1.2
February 2018

CEOS

**EXTRA**

Selected case studies and sensitivity analyses reveal that phytoplankton spectral scattering is most useful and the least ambiguous driver of the PFT signal. Key findings are that:

- there is the most sensitivity to size variability in phytoplankton backscatter ($b_{b\phi}$) in the 1–6 µm size range,
- the backscattering-driven signal in the 520 to 570 nm region is the critical PFT identifier at marginal biomass,
- while PFT information does appear at blue wavelengths, absorption-driven signals are compromised by ambiguity due to biomass and non-algal absorption. Low signal in the red, due primarily to absorption by water, inhibits PFT detection here.

The study highlights the need to quantitatively understand the constraints imposed by phytoplankton biomass and the IOP budget on the assemblage-related signal. A proportional phytoplankton contribution of approximately 40% to the total bb appears to a reasonable minimum threshold in terms of yielding a detectable optical change in $R_{rs}$.

*The Fundamental Contribution of Phytoplankton Spectral Scattering to Ocean Colour: Implications for Satellite Detection of Phytoplankton Community Structure. L Lain, S Bernard, Applied Sciences 8 (12) 2018, 2681*