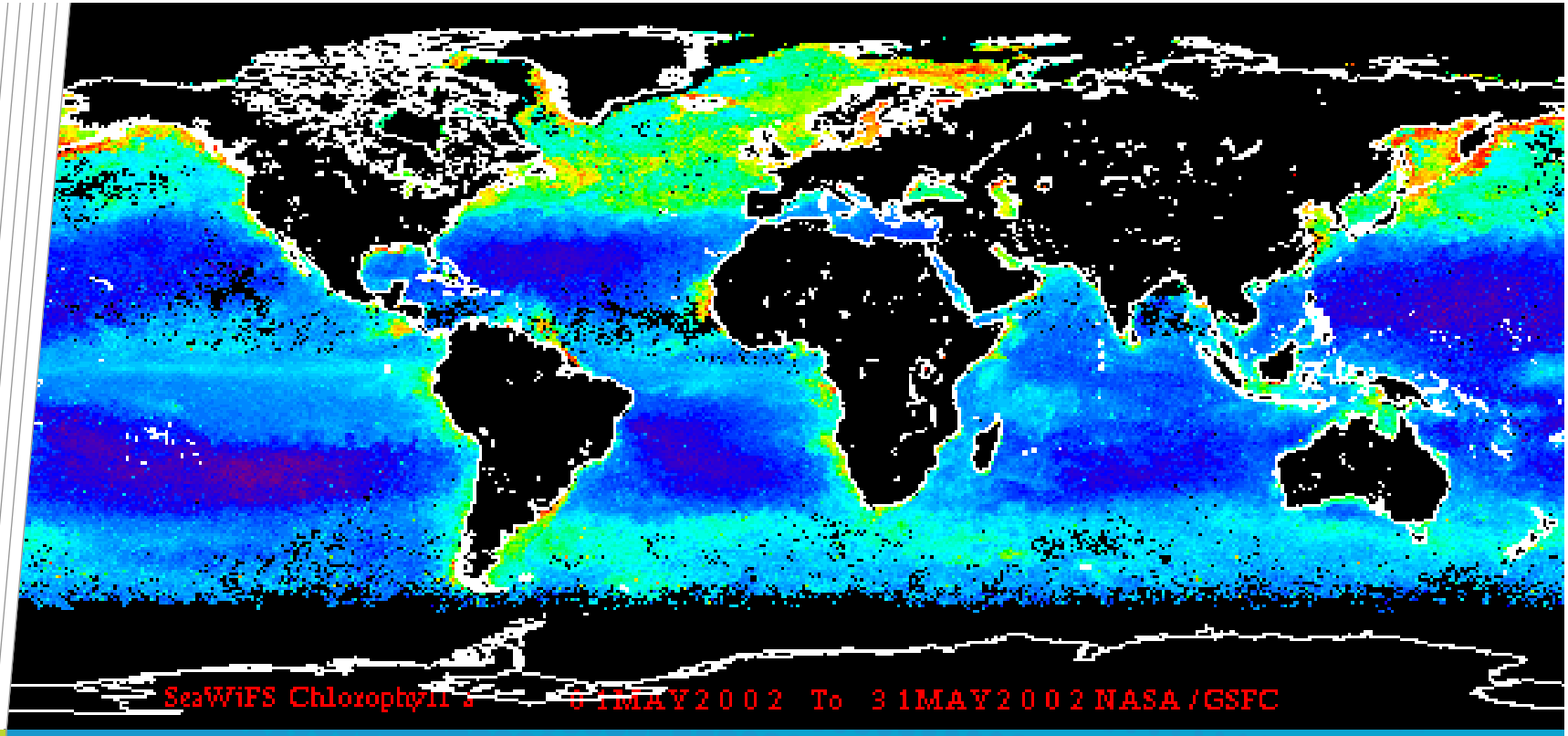

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Pigments – biomarkers of algal groups

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CSIRO Marine and Atmospheric Research
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CSIRO

Phytoplankton

- Phytoplankton are the microscopic plant life that live in the water bodies on earth – creeks - rivers – estuaries – oceans.

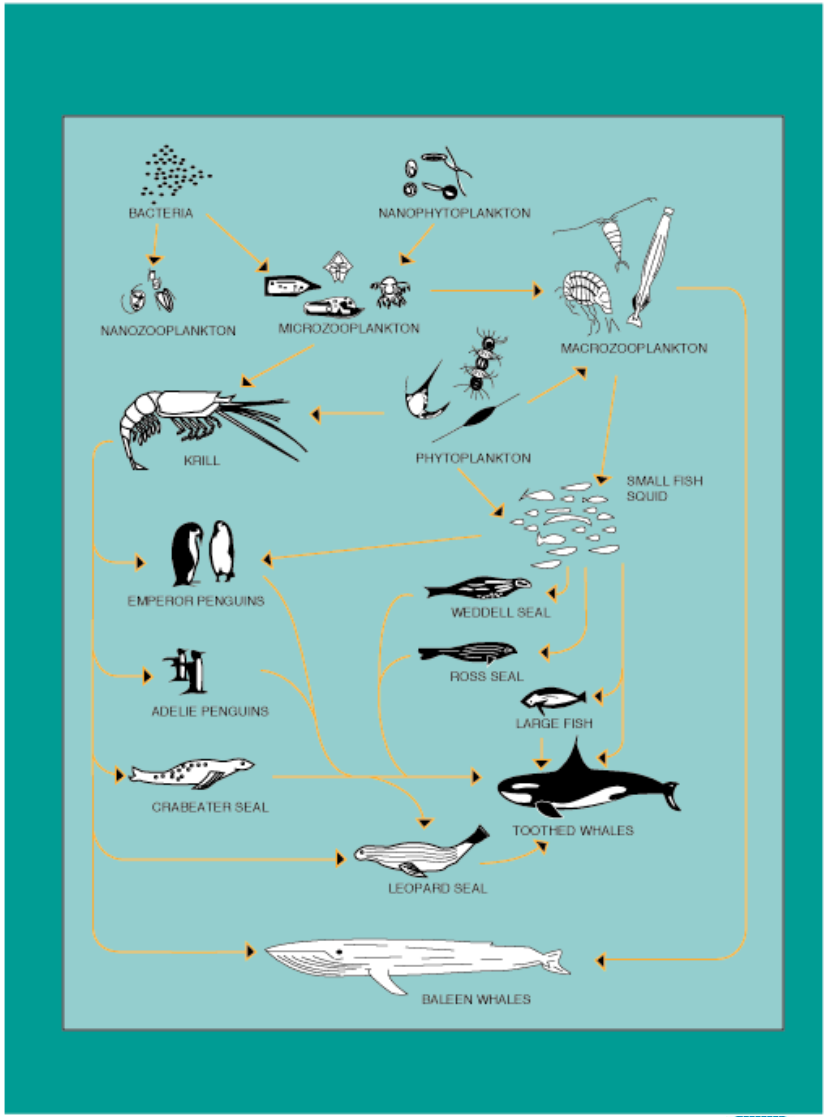
They are the base of the food chain

Phytoplankton come in a variety of shapes and sizes:

Picoplankton – less than 2 µm

Nanoplankton – 2 to 20 µm

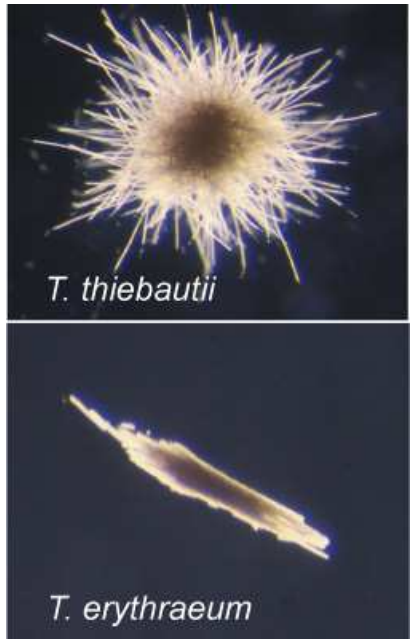
Microplankton – greater than 20 µm



Phytoplankton

Phytoplankton fall into several algal groups:

cyanophytes (include prochlorophytes))	< 2 μm
chlorophytes	1 – 40 μm
prasinophytes	5 – 20 μm
cryptophytes	5 – 20 μm
diatoms	2 – 200 μm
chrysophytes	5 – 20 μm
haptophytes	5 – 20 μm
dinoflagellates	10 – 200 μm



P. antarctica

G. catenatum

Phytoplankton

Light microscopy generally has limitations to identifying phytoplankton at around 10 μm.

Cells that are less than 10 μm wont be identified with this method.

For cells <10 μm, need to use fluorescence microscopy or flow cytometry

Microscopic methods are labour intensive and expensive.

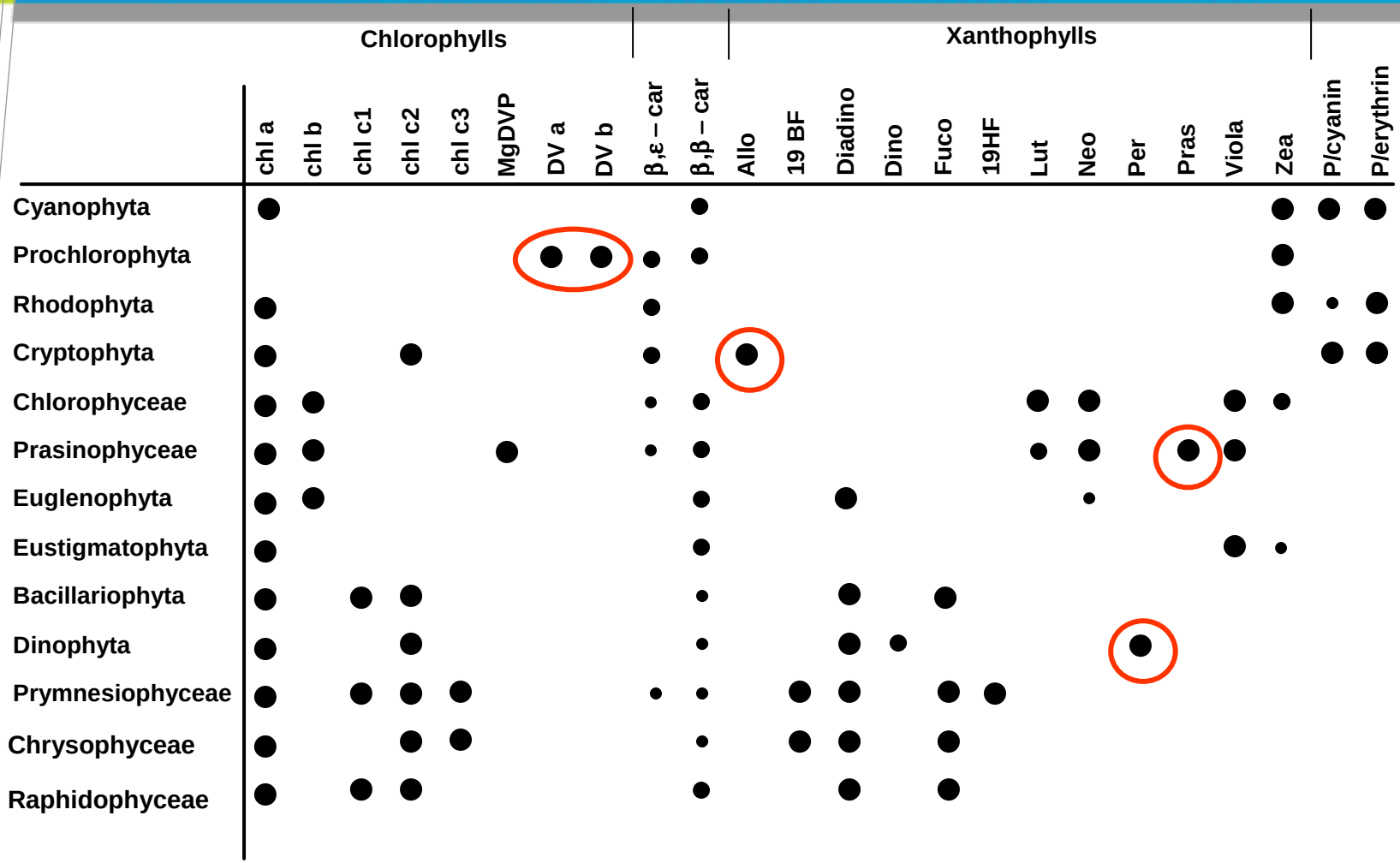
An alternative method is pigment analysis:

all photosynthetic phytoplankton have pigments

some classes of phytoplankton have a pigment that is only associated with that class of phytoplankton

- termed a diagnostic or marker pigment.

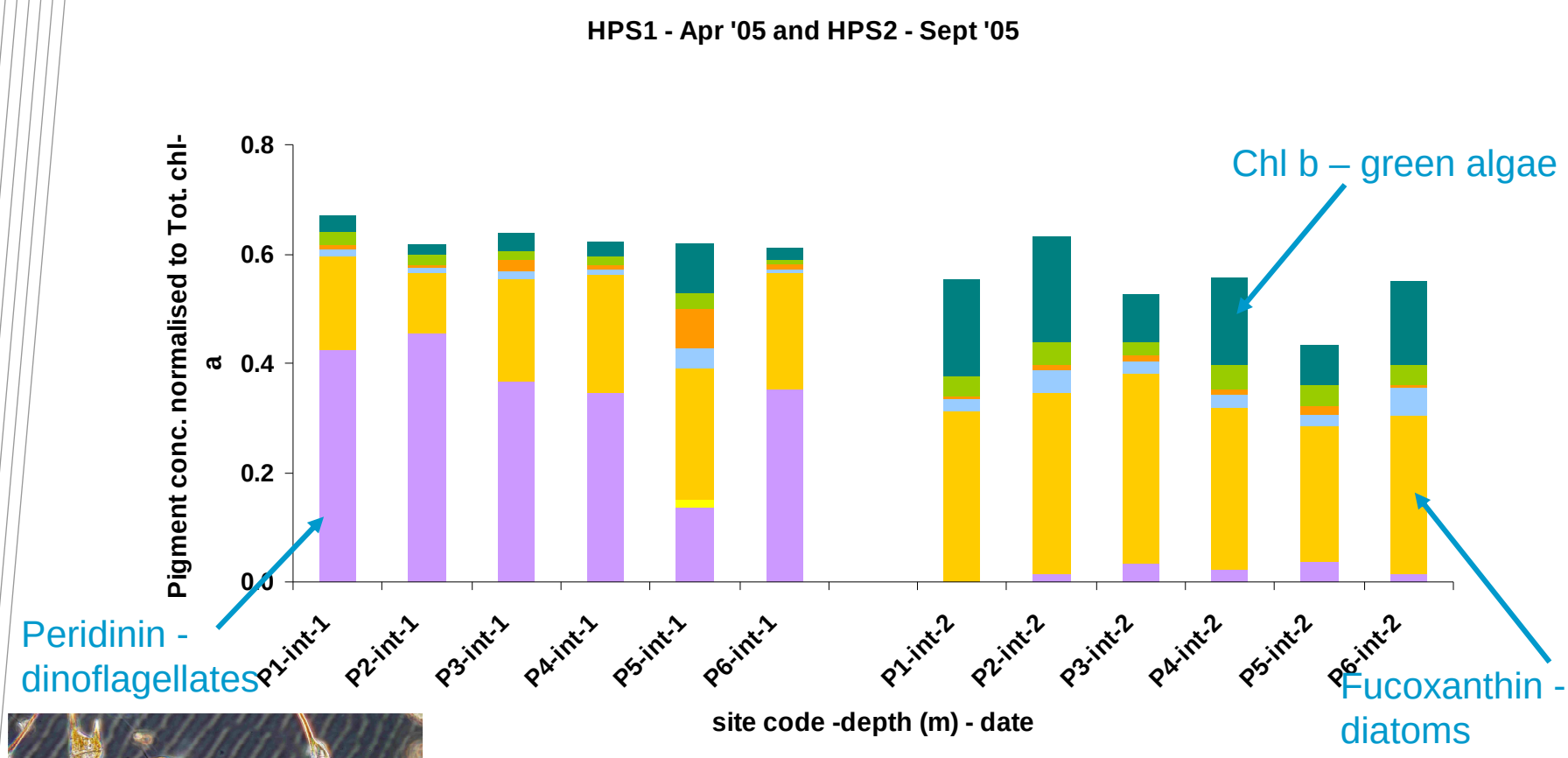
Distribution of pigments in algal classes

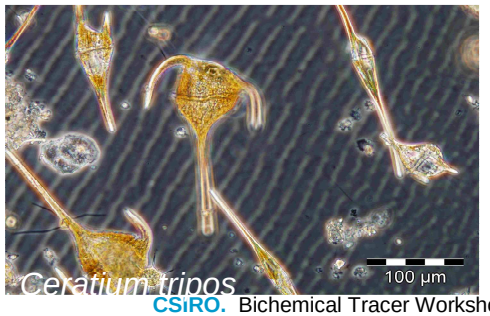


Phytoplankton and pigments

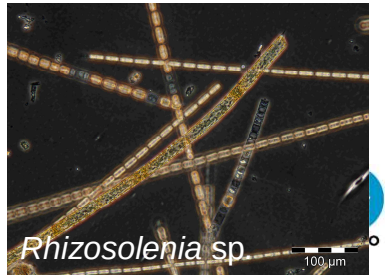
Diatoms	fucoxanthin (and diadinoxanthin)
Dinoflagellates	peridinin*
Prymnesiophytes	19'-hexanoyloxyfucoxanthin (19-HF)
Prochlorophytes	DV chl *a* and DV chl *b*
Chlorophytes	lutein
Cryptophytes	alloxanthin
Chrysophytes	19'- butanoyloxyfucoxanthin (19-BF)
Prasinophytes	prasinoxanthin
Eustigmatophytes	vaucheriaxanthin ester
Cyanobacteria	zeaxanthin (and phycobilliproteins)

Pigment analysis – coastal waters





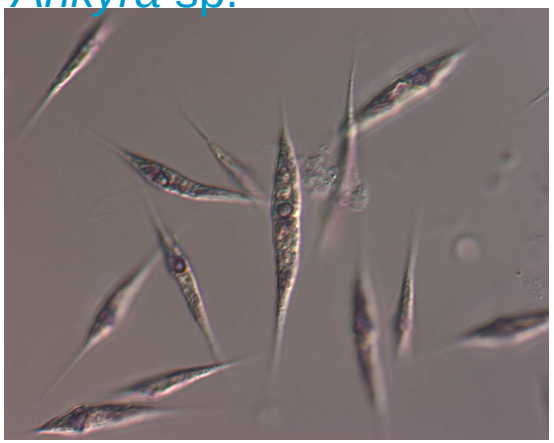
Ceratium tripos

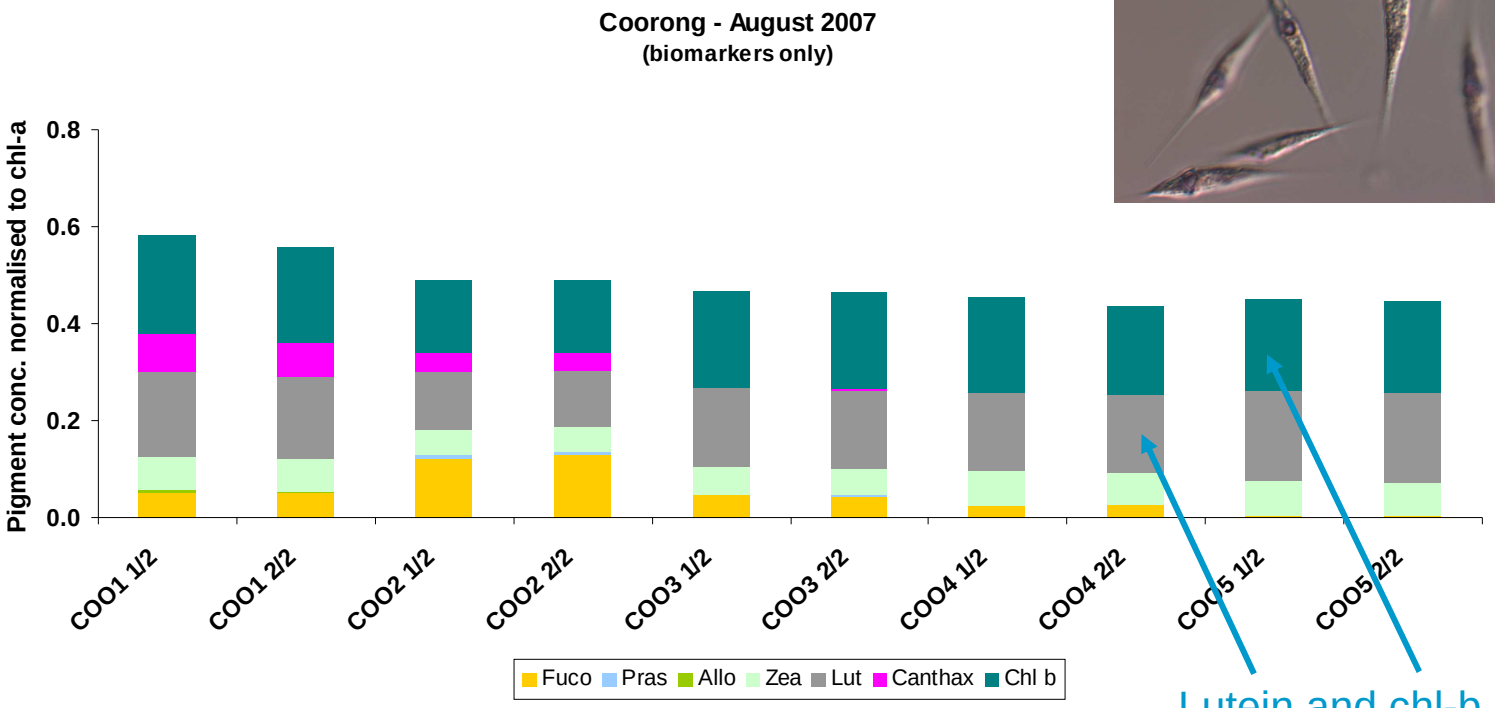


Rhizosolenia sp

Pigment analysis – coastal waters

Ankyra sp.



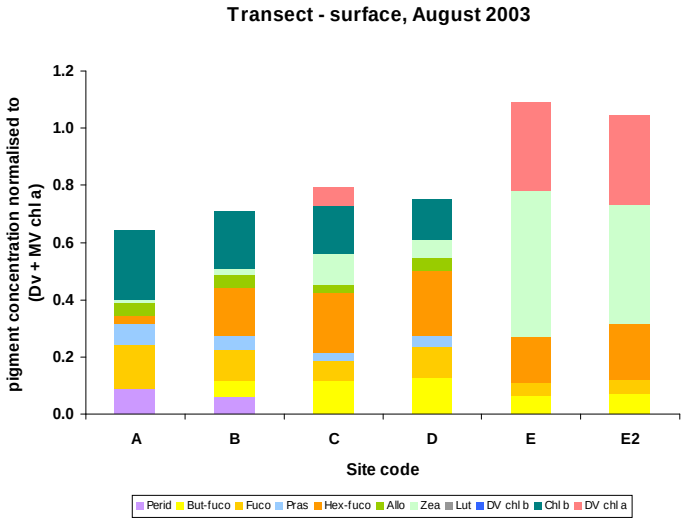


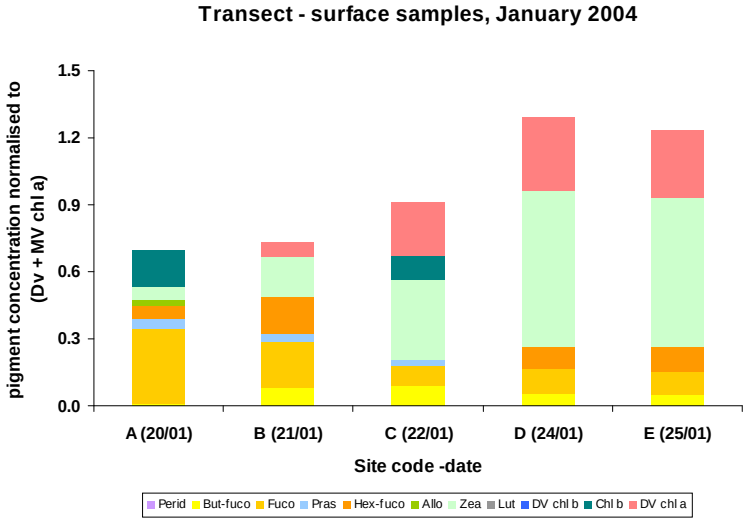
Lutein and chl-b

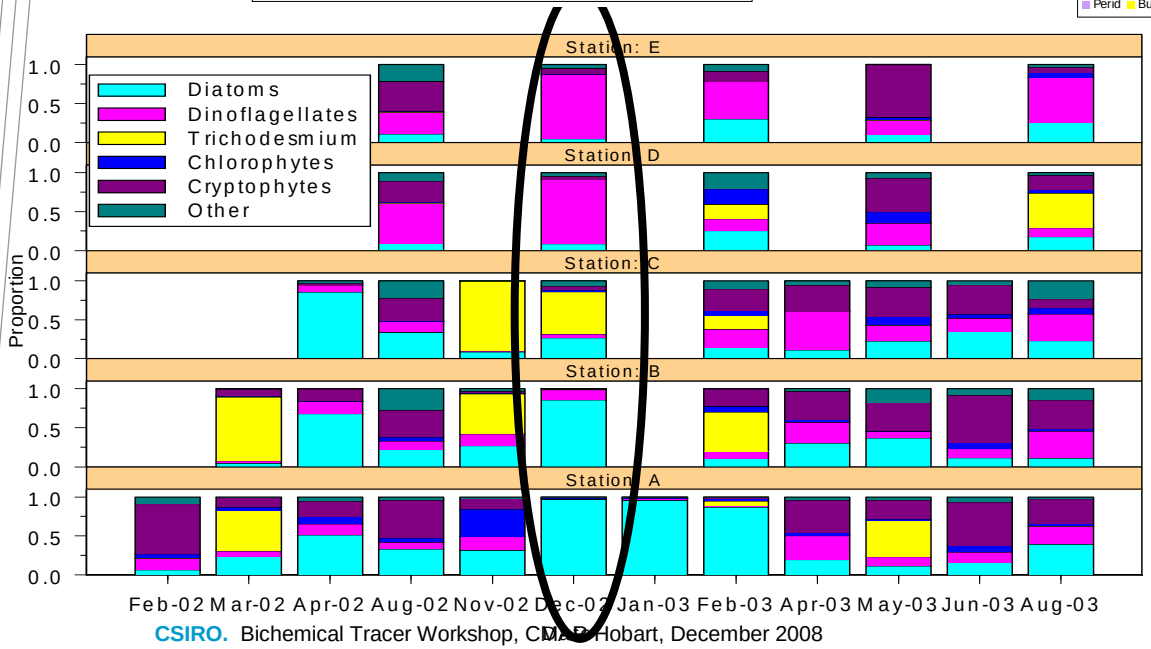
- chlorophytes

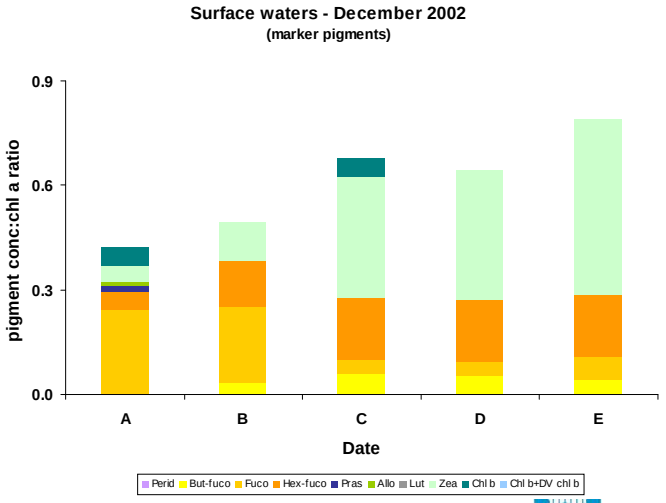
Pigment analysis – oceanic waters

Pigment analysis – spatial & temporal trends









Species markers

Dinoflagellates generally have peridinin as their main pigment.

However there are a small group of dinoflagellates that have fucoxanthin as their main pigment.

example - *Karenia brevis* (formerly *Gymnodinium breve*)

-a toxic dinoflagellate

-forms large blooms regularly on the SE coast of the USA

K. Brevis has a marker pigment

-gyroxanthin diester

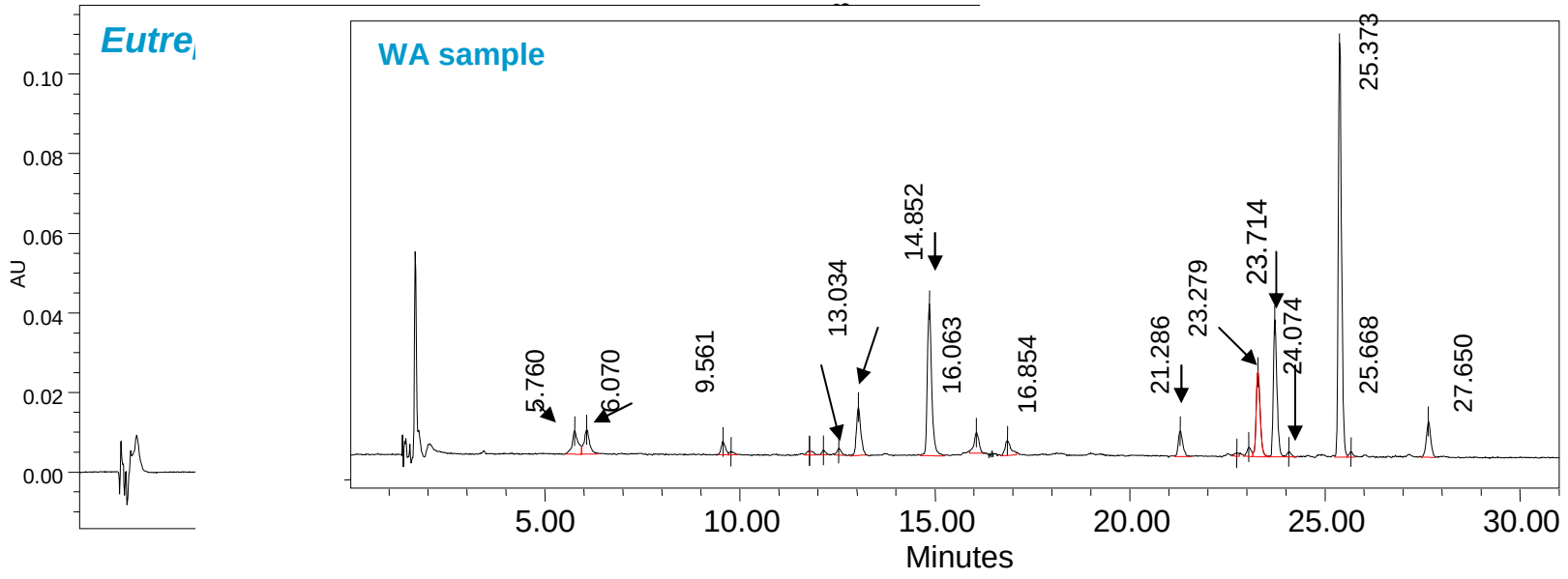
-concentration of gyroxanthin diester is highly correlated with the

K. brevis cell count

Species markers

Eutreptiella is a species of euglenophyte.

Unlike other euglenophytes, *Eutreptiella* has a marker pigment - eutreptiellanone.



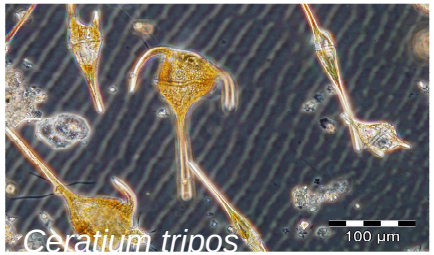
Fisheries research

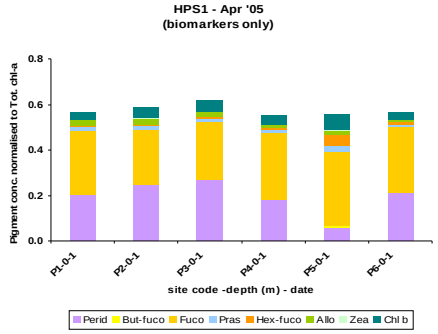
Aquaculture

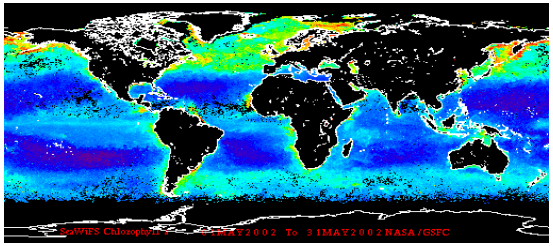
- the pigments provide information about the ecosystem

Global ocean productivity

- the pigments especially chlorophyll a can be estimated using remote sensing techniques







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